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A Trip to the Siberian Placers

By Alexander P. Rogers*

Comparatively few people have a clear conception of the east Siberian region, so the nontechnical details of a trip I made there two years ago to examine placer properties may be of interest.

Years ago, a famous American writer procured permission from the Russian government to make the tremendous journey across Siberia by stage and private conveyance to inspect the exile system; upon his return to civilization, he published an account so harrowing in its details, that the government denied him the right to enter the country again. Needless to say, his book suffered confiscation in Russia, and caused a tremendous sensation throughout the rest of the world. It gave us our first knowledge of a region where many educated and refined people were practically done to death by slow torture. Like everyone else, I had heard of these things so when the chance came to go there to examine the mining region, my interest was aroused.

Steamer "Siberia" on the Shilka

Inland Transport

Siberia is a rolling country not unlike Alaska in its physical characteristics, with great stretches covered by small pine timber. Along the southern border of the district, the great Amur River runs, into which flow a large number of small gold-bearing streams. Before the Trans-Siberian Ry. was built, thousands of convicts—both political and criminal—were marched into the various prison settlements close to these mines and forced to labor until they died or their time expired. There were few other settlers, except some roving bands of Manchus and a few Cossacks, to whom the Czar granted certain property and rights in return for military service.

Tchita No Longer a Convict Distribution Point

The city of Tchita, close to the western border and upon the Shilka River—a tributary of the Amur—was the distributing point from which the convicts were forwarded to the mines. A great stockaded prison at this place is still used for the purpose, although since the railroad has been built, the system of forwarding the prisoners has been changed somewhat, and few "politicals", as they are called, are sent there. Then, in late years, it has proved more profitable to lease most of the mines to Chinese contractors who employ thousands of their own countrymen in the work.

Another thing which changed conditions was the Japanese war. When the Russian government found that it had to give up Port Arthur and was in danger of losing its whole line through Manchuria, it set about constructing a new line from a place called Nertchinsk, near Tchita, through the heart of the mining region north of the Amur and altogether out of Manchuria to Kharborovsk, whence a line to Vladivostok already exists. This will give it an all-Russian line to its only available seaport on the Pacific. The construction of this railroad has afforded new and more pressing work for the convicts to do. It could, however, be built more quickly by employing Chinese labor, as the convict is not a willing laborer and takes his time about everything. All this information I did not gather until I had been on the ground some time.

I had secured my passport, properly viséd with a lot of hieroglyphics by the Russian Consul in New York, as this is a necessity to every traveler over there, and after securing the proper credentials in St. Petersburg, our party took the famous Trans-Siberian express for the Far East. This is supposed to be the finest thing on wheels, and perhaps it is, but like everything else in Russia, it is different in both accommodations and speed to what we are accustomed in America. To begin with, the people seem to have a natural antipathy to fresh air and a dread of using too much water for any purpose. It was warm,

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so whenever no native was looking, I opened all the windows in the car and then retired to my stateroom to enjoy the effect of this little scheme. No sooner had I assumed an innocent expression and the fresh air had begun to circulate, than an irate Russian would appear from the next stateroom forward and slam the windows shut again. That was annoying enough, but could have been overlooked had they only supplied enough water in the wash room. How can anyone wash when the basin has no stopper and all the water comes from a little can by lifting up a valve in the bottom? There is just about enough to moisten one's hands and then it is "all off."

Towns Must Bribe Railroads to Pass through Them

After we passed the Ural Mountains, great plains stretched away for miles and miles with only an occasional town in sight, and at long intervals we passed some great river flowing toward the Arctic Ocean. Often we would stop at some station and see the town five or 10 miles away on the plain. This curious phenomenon in railroad building was finally explained by our Russian guide. It seems that when the engineers laid out the line, they went to these towns and asked the city fathers what it was worth to bring the railroad to their doors. If the inducement proved insufficient, obstacles were readily found which prevented the survey passing anywhere near the town. For this reason, one of the large cities, called Tomsk, was left a long way off the line, and only lately has a branch been constructed to it.

The Russian peasants are great travelers in a modest way. All the stations were crowded with them, waiting for a train to come along. At first, they proved an interesting spectacle, with their great boots, long, unkempt hair and beard, and loose cotton shirts held at the waist by a stout belt, but their ideas of cleanliness are so foreign to our own, I soon tired of too close proximity. To these people, time is an unknown quantity, and they camp out at a station with their numerous family and belongings for several days while waiting for some train. This is looked on as quite a holiday, as the peasant seems to be a sociable fellow when he meets others of his own class. The effect upon the station, however, is to render the portion he occupies similar to a pigsty, and impart a curious burnt-leather odor to the place, which is most disagreeable to a foreigner.

When a train stops at a station in Siberia, there is little chance to get left. In the first place, it generally waits 15 or 20 minutes, and then two minutes before the train starts, a great bell is jangled on the platform. One minute later the bell is rung again; then the conductor comes out and blows a police whistle; and finally, the engineer gives a blast on his whistle, after which the engine bell is rung, and the train slowly starts, attaining after a time a maximum speed of 25 or 30 miles an hour. To be left, one must be either absolutely deaf and blind, or else demented.

All across western Siberia, we passed over great level, grassy plains with few trees in sight, and it was not until we got to Irkutsk, close to Lake Baikal, that the scenery began to change. At this place, the train was also changed and we entered what is called the Trans-Manchurian express for Vladivostok.

Around Lake Baikal, the roadbed has been cut, close to the shores, out of the sides of high granite hills covered with a thick growth of pine. It makes a pleasant change from the monotonous, endless prairies farther west. Once on the eastern side, however, we climbed up a long cañon, and in another 24 hr. arrived at the old city of Tchita, where several days were occupied in making further preparations. From here we proceeded on a branch line to Stretensk, the head of navigation on the Amur River.

For some reasn best known to the road builders, the terminus of the line is on the opposite side of the river from the town, but a "current" ferryboat transports all travelers across, when it has not been washed out by a freshet. This ingenious ferry is attached to a long cable, anchored way up stream in the center of the river, and it is only necessary to turn the bow of the boat diagonally against the current to have it drift across. It is not rapid transit, but it answers the purpose in an inexpensive way.

How Convicts Are Stored and Transported

Stretensk proved an interesting place, as it was here that I saw large numbers of convicts constantly going forward to their various destinations. They were brought by trainloads to the opposite bank, ferried over to the town and then loaded into the holds of great canal boats for transportation down the river. A crowd of several hundred of them would pass our hotel, each one dressed in a gray suit and overcoat, with the inevitable teapot in his hands, while a regiment of soldiers, bearing wicked looking rifles, marched on both sides.

In addition to his worldly goods, every convict wore iron fetters around each ankle, joined to a clanking chain suspended from his waist. It was a somber looking company marching in total silence, except for the continual clanking of the chains. Most of them seemed to be peasants, and had they changed places and clothes with their guards, I could not see that the appearance of the company would have been any different from what it was. To photograph them was difficult, as the guards would have instantly confiscated my camera had they seen me do it, but I did manage to secure one or two fair pictures by a little maneuvering.

When they reached the dock where the canal boat was tied up, the men were lined up and ordered aboard, where a doctor examined them in a cursory way, and then sent them down into the hold. After the entire company had been passed aboard, a grated hatch was locked down over the passageway and the boat moved out in the river and anchored for the night. The soldiers were distributed over the deck to guard them in their pen. Early the following morning, one of the river boats made fast and towed them down river to one of the various prison settlements.

Witnessing the same spectacle day after day is rather a depressing experience, but later on I learned that many of these men were petty criminals, who took this means of being cared for over winter. The Russian peasant leads such a hard existence, even when he is free, that he often thinks it is easier to commit purposely some small crime and be locked up and cared for during the long, cold winter.

From Stretensk, we took one of the fine river boats down stream a hundred miles to a small settlement, and there struck off on horseback through a wild wooded country toward the north. We were now in the heart of

the Czar's gold domain, through which no foreign engineers had ever been allowed to go.

Traveling in the Mining Country

Three heavy, two-wheeled carts, drawn by sturdy little horses, were used to carry our assortment of baggage and camp equipment. For saddles, we were dependent upon the Siberian article, a most uncomfortable contrivance of black, oily leather, the oil from which soon covered our clothing and made us a most disreputable looking party.

The road led through a thick forest over the rolling hills without a single habitation until 20 miles inland, the first mining settlement was reached. Occasionally we passed a few solemn peasants or a freight convoy on the road, but outside of them the only interesting objects were a number of wooden crosses where some unfortunates had been murdered by the bandits who roam about in wait for anyone known to carry gold. Every time we passed one of these crosses, our muleteers would doff their hats and cross themselves.

Our entrance into the first mining settlement created much excitement, as few of the inhabitants had ever seen a foreigner, and an American was an unknown character. I remember riding up the only street to the most imposing looking house, upon the stoop of which an intelligent looking young girl was sitting watching us, and asking her where the hotel was situated. Her only reply was to ask us who we were. After this had been explained, a request was again made to direct us to the hotel. Still she paid no attention, except to ask where we came from. Then she wanted to know where we were going. Finally, after these stock questions were answered to her satisfaction, she condescended to tell us we could secure lodging in a house right beside us, about which no living being was to be seen.

In Siberia you must be prepared to answer these three questions before anyone will vouchsafe to do a thing for you. Even the owner of the lodging house did not dare to open his doors until this information had been gained. But there may have been some method in his madness, as I later found that the young lady was one of the commanding officer's household, and the landlord was safe in the knowledge that his was the only lodging house in town. He probably was afraid to harbor us until he knew we had proper credentials, otherwise the officer in charge might have made him suffer for it.

Everywhere you go in Siberia, the same fear of the man in uniform prevails, and with the innumerable variety of uniforms, it is surprising how the exact position of every officer is instantly recognized. Without any uniform ourselves, and covered with the grease from our saddles, we were regarded by the ignorant peasants with little awe, until some officer joined us.

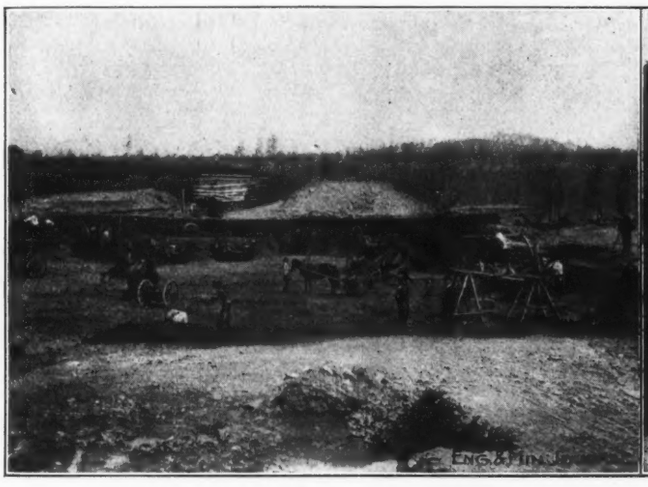
Best Miners Are the Chinese

The valley in which the gold exists at this place was leased to a Chinaman, who employed hundreds of his own countrymen to do the actual labor. They were all as busy as bees, and never stopped a minute from daylight until dark, but what power the head man had over them to obtain such constant labor I have never been able to find out. For a Russian or other foreigner, the Chinaman will not work anything like as hard. I suppose, however, that they managed to steal a part of the gold in some dark way, as I know their masters did before it reached the Czar.

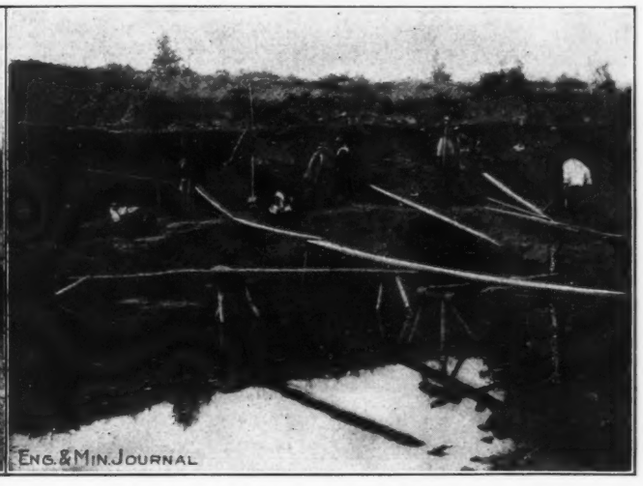
Each day, just before the men quit work, a Russian overseer came around to the washing pits and took up all the gold that had collected in the little sluices. This was then weighed and the lessee's proportion kept one side until the day of settlement.

The Chinaman is such a patient and industrious fellow, he never fails to interest me. Here there were hundreds of them shoveling the dirt into clumsy little wheelbarrows, and wheeling it way off one side to the water, all the time carrying on a chattering conversation with their neighbors. Our appearance greatly puzzled them, and started a long discussion everywhere as to whether we were English or some other race. Someone had told me the Chinese words for Englishman, foreign devil, and American, so I could guess what they were talking about and allay their suspicions occasionally by simply saying we were foreign devils.

As our itinerary in this district covered a distance of about 250 miles around a great circular area, the stops at each mine were not more than a few days' duration. The roads between the mining districts were little more than trails with great rocks or mud holes every little way, so that we considered the day lucky when our two-wheel,



Stripping Gravel at Chorogotsha



Workings at Divenda

top-heavy carts did not upset more than two or three times and dump the baggage into the mud. At night, if no town was reached, we crawled into our blankets beside the road, but always with our pistols under the pillows. I had no desire to be held up by some roving Chinese or Russian bandit, if it could be avoided, and we never were, but a party of Chinese miners once gave us a good scare. We were riding along through some thick woods one morning, when suddenly a mounted Chinaman appeared round a turn about 200 ft. ahead, and immediately dismounted. He was armed to the teeth with several enormous pistols and a huge knife in his belt. Directly behind him, about 15 more Chinamen similarly mounted and armed, appeared and halted across the path. Just as we were drawing guns and preparing for trouble, a Russian, whom we knew, was seen in their midst and relieved the tension, much to the relief of everybody. They turned out to be contractors from a distant mine, and had just taken their gold to the Russian officials in charge of the district. When we met them, they were on their way home, and happened to stop just in front of us to take a rest. The Russian in their party was a good people were so hospitable we had great difficulty in leaving at all.

They were especially worried when I told them we expected to camp out that night along the road, for fear we would catch malaria from a slight mist which rose over the river, and insisted that we stay at their house until morning. Knowing that it would be just as difficult to depart next day, I decided it was better to have it over with at once, and take our leave.

Malaria in a country like that seems like a huge joke to anyone who has camped in tropical South America; but these people had come directly from the environs of Moscow to this lonely region, where it was a rare occurrence to meet anyone except ignorant convicts or drunken peasants, so I hardly blamed them for being timid and delaying the parting guest as long as possible.

We now seemed to be traveling through a country reserved for various kinds of convicts, and I was always on the lookout for the interesting ones. A few days after bidding goodby to our engineering friends, we came upon a nice looking old man who lived in the direst poverty with his wife in a rough log cabin, miles

CHINAMEN WASHING GRAVEL AT KUDYECHI

SAMPLING ONE OF THE WORKINGS AT KUDYECHI

professional gunman who made a business of protecting such convoys.

After traveling north 70 or 80 miles, we finally reached the new railroad grade and followed that to the eastward for one hundred miles, until the boundary of the district was reached. It was an eye-opener to me in the art of railroad building. In spots, peasants and convicts were at work slowly building up embankments or cutting away the hills, while alongside was a perfect automobile road used for hauling materials. All the stations and section houses were completed and even the towns were nearly finished. But no rails were laid, and none would be for a long time to come. The Russians believe in having everything in readiness before the trains are run, a practice which seems strange to one accustomed to our own Western country, where the railroad comes first and brings the people afterward.

At an isolated spot along this grade, we came upon one of the division engineer's houses and were most hospitably entertained. The engineer himself spoke no English, but his wife was proficient in it and took great pains to make our call a pleasant one. In fact, these away from every one, except for a dozen Chinamen who were working in a mine near-by. He was most hospitable, however, and insisted upon our taking a glass of tea with him—a custom which is followed on every occasion, and at any hour of the day or night, in Siberia. After we had broken the ice in this manner, he became much more talkative and explained that he had originally lived in Poland.

His offense had been to fight for his country's freedom when a young man, 40 years before. For that, he was sentenced to the Siberian mines for life, but after serving 10 or 15 years, his sentence had been lightened somewhat by allowing him to live in this desolate spot, practically alone, provided he reported to the authorities in a town 50 miles away, once a month. The furnishings of his cabin were of the barest, with only a few books and a little old-fashioned spinnet against the wall, from which a weird sound could be obtained. He explained to me that this was his only association with the past, when he had been fond of music. I could not help thinking what an outlook that was for one who had been brought up to the good things of life.

Kodak Ends a Chinese Tea Party

The next people we visited were of a very different character, however. We had been interested in examining a large mining field where hundreds of Chinamen were occupied. The head contractor—who was an intelligent looking Chinaman—wishing to show us some courtesy, asked several of our party to tea one afternoon—an invitation I promptly accepted, as this man had a reputation throughout the country. Upon our arrival at his house, we were most cordially received and served with delicious tea and cakes, after which I proposed to take a group picture of the party. It was rather a unique experience to me, and I thought they would consider it in the same light, and jump at the chance. Imagine my astonishment, however, to see the whole crowd scurry away and hide the instant they caught sight of my camera and realized what I was going to do. No amount of persuasion had any effect on them, and the only ones I succeeded in getting in the picture at all were the cook and his helpers. Incidentally, it produced rather an embarrassing leave-taking, as we could not even find our hosts when we departed, and had to leave word with the cook that we had had a good time.

Upon reaching the eastern border of the royal preserves, we headed south again, and after a few days' travel, reached the Shilka River at a steamboat landing. These boats have no fixed schedule, and we were obliged to wait a day or so before one came along and picked us up. It is a pleasant trip, either up or down the Amur and its tributaries, as many of the steamers are good ones and the government has established a continuous system of lighthouses and beacons to mark the channel. Our journey, however, was completed at Stretensk, whence the railroad carried us back to civilization.

Siberian Mining Conditions Not So Bad as Depicted

While this expedition had proved most interesting, it failed to show me, from a visitor's point of view, anything sinister about the terrible Siberian mines. They were just the same as our own Alaska fields in the early days, before the country became thickly settled, and it seemed rather unjust for the reformers to refer to them as a pest-ridden loathsome spot. The winters are undoubtedly long, forbidding seasons, but there is nothing unhealthy about them. It was the iron heel that caused the rub, and I suppose the same effect could be caused by banishing a volatile, excitable or sensitive person from city life to solitary confinement for life, at hard labor with poor food and uncleanly surroundings, in our own lovely Adirondack region. The moral effect is too great for the average person to stand.

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British Metal Trade in 1912

The imports and exports of metals in Great Britain for the year ended Dec. 31 are given in the table below, the figures being in long tons, except for quicksilver, which is given in pounds.

	Imports		Exports	
Metals	1911	1912	1911	1912
Copper	140,592	130,581	72,604	57,441
Tin	63,208	60,348	45,589	43,663
Lead	218,707	205,375	61,982	58,685
Spelter	134,341	157,604	9,591	10,709
Minor metals	6,193	7,889	22,946	28,549
Quicksilver, lb.	3,491,016	3,544,691	2,357,916	2,418,043

Copper and tin totals include metallic contents of ore and matte. Tin ore and concentrates imported were 28,837 tons in 1911 and 28,652 in 1912, principally from Bolivia and South Africa. Minor metals include nickel, aluminum and the minor metals and alloys. Exports include reëxports of imported materials.

Imports of pyrites were 849,941 tons in 1911, and 907,157 in 1912; increase 57,216 tons. No exports of pyrites are reported.

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Beneficiation of Lake Iron Ores

By Dwight E. Woodbridge*

Various projects for the beneficiation of the Lake ores of low grade, the inception or inauguration of which was referred to a year ago, in the review for 1911, have been carried forward to their issue. The two ore driers put in at the Brunt mine, of M. A. Hanna & Co., a year ago, are to be increased by two Ruggles-Coles driers, and the former two are to be rebuilt and straightened for a greater product. The two machines will be, like the others, of the cylindrical rotating type, and are to have a diameter of 90 in., with lengths of 55 ft., set on trunnions. They will have guaranteed capacities for drying an ore carrying 18% moisture down to 6%, and each will handle 22 tons or more per hour. High temperatures are requisite, and it has been found that earlier machines were not of sufficient strength. The two Atlas driers in use at the Brunt the past season have handled 105,000 tons, which has been mixed with the raw ores from the mine, thus bringing down the moisture content of the entire shipment. Elimination of moisture at the mine reduces weights and increases the worth of the ore, both as to the price calculation and as to its value in the furnace.

Concentration of Ore

The same firm is operating a jig and slime table concentration mill at its American-Boston mine, on the Marquette range. This was built last summer in order to treat low-grade hematite ore occurring in the mine in considerable quantity. Its stated capacity was to be 500 tons of concentrates per day, but this has not yet been reached, on account of the fact that the mill is to a certain extent an experiment, and that skilled milling help has been hard to get. Many changes have been made, and others are still in progress, and it is expected that a daily output of about 600 tons of about 60% ore will be assured soon. This mill is fitted with Richards pulsating jigs as the main concentration device, and its operation is being watched with the deepest interest about the Lake. There is a vast tonnage of lean hematitic ore on other ranges, whose value depends upon some method of improving its grade to a merchantable point. On the Cuyuna range this class of ore forms by far the larger proportion of the total tonnage shown and may readily amount to more than a thousand million tons. There are many drill holes that have pierced 500, 600 or 700 ft. of material running 40 to 45% iron, with a siliceous gangue, that should come in some time, if the elimination of this gangue can be accomplished economically, and there should be no more difficult problem than its success would warrant.

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Calcining Works

The erection of a siderite calcining works at the Magpie mine of the Lake Superior Corporation has been delayed and it will be late next fall before this plant is completed, though one of the three contemplated units will be ready and at work in the early spring.

Very little progress has been made with the Jones step-process furnace, operation of which at the Kloman mine was promised for a year ago. This experiment was an attempt to convert into a commercial product low-grade hematite ores of the Lake Superior ranges by bringing the ore into contact with heat and so driving off the oxygen of the ore without in any way fluxing or melting the iron or gangue found in the ore, and subsequently to crush and concentrate magnetically, so as to bring the ore to a high degree of purity. So far the experiment has not met with success and on account of the large amount of money required to carry it forward, work has ceased for the present, although experiments are in progress at Harvard. Mr. Jones hopes to reduce the amount of fuel required for the operation of metallization and thus to make the proposition more attractive. For the sake of the tremendous results that will accrue to the Lake Superior region should such a process render available ores that can be deoxygenized, it is to be hoped that ample success will finally crown the efforts of the sanguine men who have carried this work as far as it has gone.

The Grondal Process

A Gröndal concentration and briquetting works has been built at the Moose Mountain town of Sellwood, and will be in operation shortly. There are large quantities of lean magnetic ores, with a gangue very similar to the ores of Sydvaranger, that can be treated by this works. Magnetic concentration of other large available deposits near the Lake is now under consideration by several large mining and steel-making interests, and there may be considerable to say as to this branch of the subject by another year.

Desulphurizing Pyrrhotites

The Canadian Northern Ry. Co. has employed engineers from England who have reported that pyrrhotite deposits along its main line some 130 miles west from Port Arthur, are suitable for desulphurizing into an iron ore from which bessemer steel can be made, and development along that line is to be undertaken soon. These pyrrhotite ores carry up to 25% or over in sulphur, and the promoters of this enterprise state that they hope to manufacture sulphuric acid from the waste gases.

Oolitic Ores

At the works of the Northwestern Iron Co., at Mayville, Wis., a plant for the briquetting of the oölitic ores mined there has been put into use and the extent of the general operation is to be greatly extended. Additional ore deposits have been found and are under development; the furnace capacity is to be increased and rumor has it that the Schlesinger interests, that control the property, are to erect steel works at some point near Chicago, a large portion of the pig-iron supply for which will come from Mayville.

Improving Low-grade Ores

Interest in the general subject of iron-ore concentration, attention to which was called a year ago, continues to grow. The improvement of low-grade ores of the United States, in order to permit their use in the furnace, is recognized as one of the great questions before the trade today. Elsewhere than about Lake Superior, there is the same growth of interest and the same activity in research. The United States Bureau of Mines has conducted experiments looking toward the elimination of titanium from titaniferous magnetites, of which there are several hundred millions of tons in New York state and other parts of the northeastern district, and in Minnesota. Experiments are also under way with the view of making a commercial ore of the vast tonnages of lean siliceous Clinton ores in the Birmingham district that are now disregarded. In the Port Henry region of New York State additional and more refined magnetic concentration capacity is in successful operation.

Washing Sandy Ores

During the past year a sand washery was built by the Wisconsin Steel Co., for its Hawkins mine, Mesabi district. It was in use for most of the shipping season and of the 650,000 tons of ore mined all but 150,000 tons were put through it for beneficiation. The mill was planned for a stated capacity of 5000 tons of concentrates per day, but has exceeded that figure by 50%. The Hawkins mine contains many millions of tons of sandy ore that can be washed at a high profit. At the great sand washery of the Oliver Iron Mining Co., at Coleraine, Mesabi range, a total of 2,500,000 tons of washed ore has been turned out in the season, and the plant has handled as high as 90,000 tons per week. This plant was built for a capacity of 10,000 tons a day but has run to 50% overload. A small log washer has been built at the top of the shafthouse of the Madrid mine, at Virginia, and the mine has shipped 26,000 tons within the past few months. Washing of such Mesabi ores as are suited to the operation may be extended to other properties during the present year.

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Coniagas Mines, Ltd.

The report of the Coniagas Mines, Ltd., for the year ended Oct. 31, 1912, shows silver shipments of 3,508,377 oz., contained in 650 tons of ore and 1287 tons of concentrates, and dividend payments of $1,440,000. The total tonnage milled was 53,627, or 2.86 tons per stamp per 24 hr. There were 803.3 tons of high-grade concentrates shipped, and 484.2 tons of low-grade slimes. The heads to the mill carry 34.12 oz. per ton, the sand tailings 4.29 oz., and the slime tailings, 7.29 oz. They are being stacked separately on the company's property. The concentrates carried 1,564,164 oz. of silver.

Ore reserves are now estimated at: 4480 tons high-grade ore @ 3000 oz., 13,440,000 oz.; 108,740 tons of milling ore @20 oz., 2,174,800 oz.; 37,800 tons broken rock on top of stulls in mine @40 oz., 1,512,000 oz.; 10,500 tons milling ore on dump, @30 oz., 315,000 oz.; total 17,441,800 oz. The reserves show an increase of 1,400,000 oz. during the year. Ore in transit, cash, and bills receivable amounted to $1,379,349 on Oct. 31, 1912.

Cyanidation at Cripple Creek, Colo.

By Herbert A. Megraw

SYNOPSIS—A review of cyanide operations at one of the principal gold-mining camps in the United States. The ore is rebellious and has not been successfully treated by direct cyanidation, although the attempt is now being made at the Ajax mill. The practice at the Portland and Stratton's Independence, the most important plants, is similar in many ways. At the Independence the principal features of the practice are comparatively coarse crushing in cyanide solution in chilean mills and careful concentration. A high-grade concentrate is made and a middling is reground and reconcentrated. Sand and slime are cyanided separately, the former by leaching and the latter by agitation with cyanide and bromocyanide. A vacuum filter is used and solutions are precipitated on zinc shavings after being clarified. Precipitate is sold instead of being treated at the plant.

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The Cripple Creek district of Colorado is one of the most famous gold camps of the world and has, at times, been called the richest gold district in existence. Although this can hardly be said to be true at present, still the district is of great importance and continues to produce gold in large quantities. Its minerals are too well known to require any detailed description at the present time. The occurrence of tellurides of gold is distinguishing and is the principal feature which opposes simple reduction methods.

The metallurgy of the ores of the district has passed through all the changes common to most of the gold camps of the United States, plate amalgamation, chlorination, concentration and finally cyanidation having been applied to the minerals with varying degrees of success, not to mention the procession of patented and secret processes which have made one brief appearance and then vanished forever. At the present time cyanidation, occasionally alone but more generally in combination with concentration or some other metallurgical means, notably roasting, is applied to all the ores which are too low grade to smelt, and the process has become essential to the life of the district.

Mine and Mill of Stratton's Independence, Ltd., Victor, Colo.

Many Mills in Operation

There are a number of mills at work in the district and in addition to these a quantity of ore is shipped to the two large custom mills operating at Colorado Springs. The richer ores are smelted but the quantity of this product is not so important as it was in earlier days. By far the greater quantity of ore is milled and the cyanide process is responsible for the recovery of a large part of the gold.

Most of the mills in the district, or at any rate the most important ones, use a combination of concentration and cyanidation, the idea being to remove, as far as possible, the tellurides, sulphides and other refractory compounds which do not yield readily to cyanide treatment, leaving a tailing which is satisfactorily treated with cyanide solutions of low strength and at reasonable cost. Some of the plants are simple leaching installations treating ore or waste of low grade and in different degrees of fineness, but these present no metallurgical novelties and are simply efforts to extract a profit from material available without reference to technical niceties or conservation of resources.

Of the more important mills which are following modern practice and obtaining results which are satisfactory in various degrees, may be mentioned those of Stratton's Independence, Ltd., the Portland Gold Mining Co., the Ajax-Colburn and the Blue Flag Mining Co. Of these the Ajax is the principal one which has made serious attempts to obviate the use of both concentration and roasting and use the cyanide process direct, making use of chemical means in combination with the cyanide solutions to dissolve the refractory gold compounds. This mill has installed the Clancy electrochemical method of procedure and is now in process of ascertaining what benefits may be expected from

Note—This is the seventh in a series of articles by Mr. Megraw on American cyanide practice. Previous papers appeared Nov. 2, Nov. 23, Dec. 14, Dec. 21 and Dec. 28, 1912, and Jan. 4, 1913.

it. At present there is not sufficient information available to enable a statement which will definitely prove either success or failure for the system, but it is hoped that within a few months data for the settlement of the question may be forthcoming. The serious attempt of the operators of this plant to solve a difficult problem along scientific lines is worthy of the complete success that they hope to obtain.

Separate Dry Crushing at Ajax

The Ajax has installed a plant entirely separate from its cyanide mill in which the ore is crushed dry and mechanically sampled. The ore is brought into this plant in electrically moved cars and is passed through a series of crushers, rolls, screens, etc., being sampled during the process, and is finally delivered in a condition sufficiently fine to be mixed with the cyanide solutions and classified, any oversize being led directly into the tube mills for regrinding. This, I believe, is the first attempt in the Cripple Creek region to slime all the milling ore and treat it directly by cyanide. The statement of proven results will be awaited with interest.

The Blue Flag mill is another which is making a trial of a comparatively new development of cyanidation. It is equipped with machinery for the continuous-decantation process using Dorr thickeners in conjunction with agitation tanks of a well known design. This process presents some innovations which are of great interest at this time and will be discussed in a separate article.

Portland and Independence Mills Similar

The mills of the Portland Gold Mining Co. and Stratton's Independence, Ltd., are similar in many ways, the principal difference being that the Portland makes a total slime product, while at the Independence the sand and slime are treated separately. Due to the fact that the Portland company does not desire to make public any details of its practice at the present time, no information can be given, but it will be safe to accept the practice followed at the Independence as typical of successful work in the Cripple Creek district and its system, which is made public without reserve, will form the bulk of this article.

At this mill a long series of experiments was conducted by Philip Argall and it was decided that the most feasible method was careful concentration of the ores followed by cyanidation of the tailing. The adaptability of this system was due to the fact that the ore contained a quantity of gold in the form of telluride which is not easily cyanided by direct methods and it was considered advisable to remove this constituent and extract its gold content by some means more satisfactory. A mill to treat 5000 tons per month was erected to make use of this method. The mill was afterward increased to handle 10,000 tons per month, at which capacity it is now operating.

Independence Mill Treats Dump Ore Chiefly

The ore supply comes mainly from the dumps, a large accumulation of this material having resulted during the long life of the mine. The average content has a value of about $3.50 per ton as milled. An electric shovel is used for moving the material, which is loaded into 4-ton cars, hoisted up an inclined plane and delivered into the crusher house.

From the head of the crusher house the ore is delivered to a No. 7½ Gates gyratory crusher, which delivers its crushed product to a picking belt three feet wide. Here the larger boulders of barren rock are thrown out as much as possible and the belt carries the remaining material to a No. 5 Gates crusher, in which the ore is reduced to about 1½-in. cubes and conveyed, by means of an 18-in. conveying belt, to the steel storage bin. The sorting does not materially increase the value of the ore, less than 3% being removed in the process, which is of more importance on account of the quantity of pieces of wood, steel and much other foreign matter which comes from the dump.

The steel mill bin is of special design and was installed with the idea of obviating blocking or sticking of the ore, which object has been attained. It consists of a steel cylinder, the bin proper, terminating in

COSTS AT STRATTON'S INDEPENDENCE MILL

	Per ton treated	
Dump breaker		
Power	$0.0436	
Operation	0.0516	
Repairs	0.0681	
Total		$0.1633
Crushing and concentrating		
Power	0.1946	
Operation	0.1192	
Repairs	0.1982	
Loading concentrate	0.0097	
Total		0.5217
Cyaniding		
Power	0.0484	
Operation	0.3420	
Repairs	0.0549	
Total		0.4453
Miscellaneous		
Heating	0.0050	
Water service	0.0048	
Liability insurance	0.0057	
Fire insurance	0.0298	
Taxes	0.0465	
Total		0.0918
Mine breaker [1]		0.0169
Total cost		$1.2390

[1] The mill receives one-tenth of its supply from a small breaker plant where mine ore is crushed to ¼ in. and taken directly to the chilean mills.

a cone-shaped bottom. The apex of the cone is cut off leaving a circular opening four feet in diameter. This opening is set down into another smaller cone, the feed cone, which has a 12-in. opening delivering the ore to a revolving disk feeder. The opening in the bin bottom is large enough to prevent blocking and is small enough to relieve the feed cone of excessive pressure. The device works successfully and the bin can be entirely emptied of its contents without shoveling. The ore stored in the bin is all reduced to smaller than 2-in. cubes.

From the storage bin the ore is fed through two sets of 16x36-in. rolls which reduce it to about ¼-in. size. Due, however, to the flaky character of the ore, largely phonolite, the size is more nearly ⅜ in., although its thickness is generally less than ¼ in.

Lime Added to Coarse Ore

The ore coming from the storage bin is slightly moistened with cyanide solution which tends to settle the dust and also to slake the lime which is added at this point. By means of this procedure it is calculated that the lime shall be in good condition to render effective service, and by the passage through the rolls

becomes thoroughly mixed in with the ore and probably reaches every part of it. Being in a damp condition, the time of passage through the rolls to the mill bins and the time it remains in the latter should be sufficient for a thorough neutralization of any latent or developed acidity in the ore. The system of adding lime to ores in cyanide milling has been the subject of much discussion and the methods used are extremely varied. It is of considerable interest to note the methods and reasons adopted at the different plants, and a final comparison of them will be valuable and of technical interest.

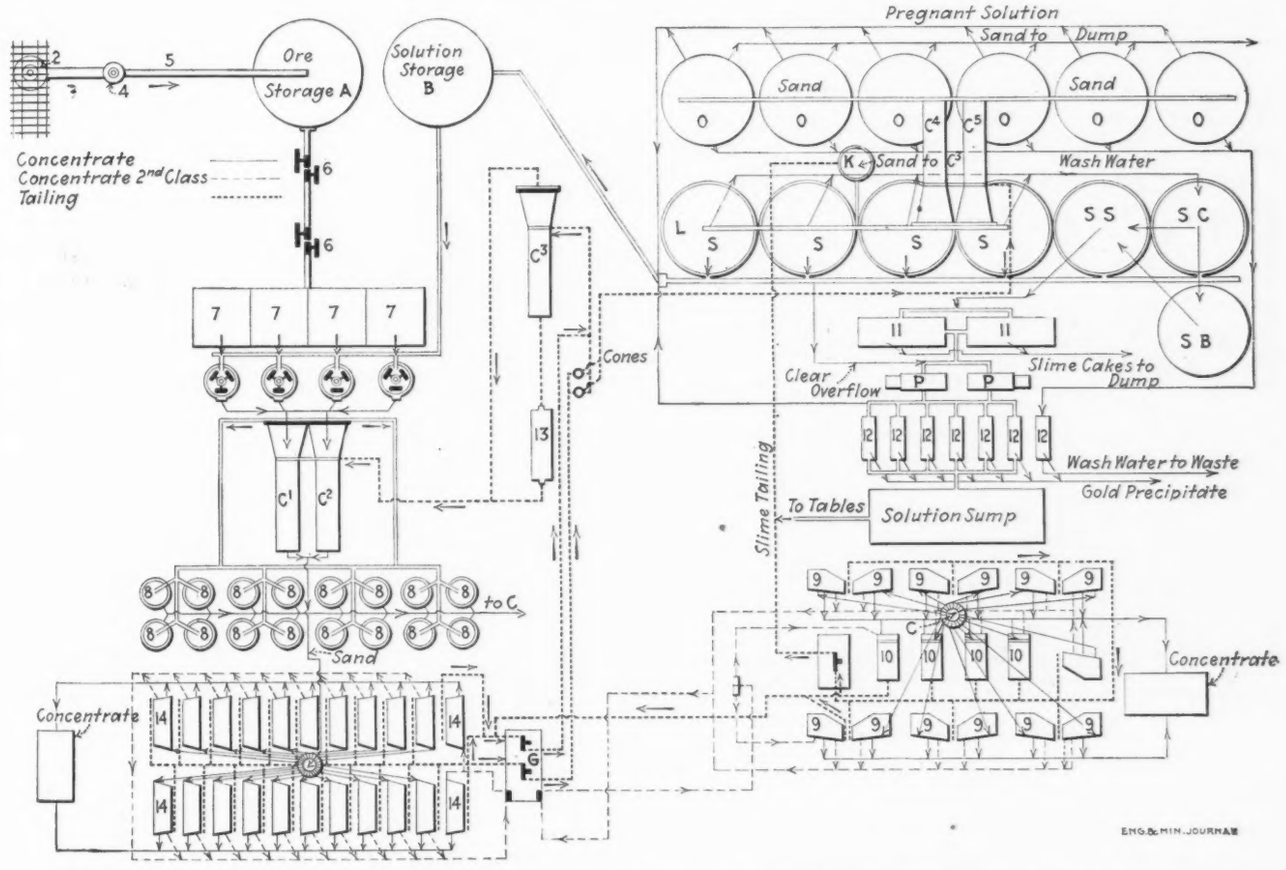
Chilean Mills Used for Fine Crushing

From the rolls the ore is taken to the storage bins above the chilean mills, which are used for fine crushing. The fine-crushing plant consists of four 6-ft. Akron chilean mills. Three of these are kept in operation all the time, easily crushing the required amount of 10,000 tons per month, the third being held in reserve and ready for use at any time. The mills can each crush from 100 to 130 tons per day, according to the feed they receive. The ore is fed into them by means of revolving-disk feeders which may be adjusted to any required capacity.

The mills are fitted with square wire screen having 0.046-in. aperture and 0.054-in. wire. The speed is about 33 r.p.m., and with this adjustment, using the normal character of ore feed, they crush almost exactly five tons per hour with an expenditure of 55 hp. With the mill in average condition the pulp delivered from it has the following approximate composition: On 50 mesh, 21%; on 100 mesh, 12%; on 150 mesh, 5%; through 150 mesh, 62 per cent.

The total steel consumed per ton of ore milled, using Midvale or Latrobe brands, amounts to 0.62 lb. The crushing pressure of the mill amounts to about 900 lb. per sq.in., which is probably somewhat increased by centrifugal force.

The chilean mill has been generally considered a sliming machine, but the operators at the Independence mill have found that within certain limits it is able to give a fine, yet granular product. The adjustment, however, must be made with a view to the result desired.



Flow Sheet of the Concentrating-cyaniding Plant of Stratton's Independence, Ltd., Victor, Colo.

1, double-track inclined plane; 2, No. 7½ Gates gyratory crusher; 3, picking belt, 3 ft. wide; 4, No. 5 Gates crusher; 5, conveyor belt, 18 in.; 6, rolls, 16x36 in.; 7, Chile mill stock bins; 8, thickening cones; 9, No. 3 Deister tables; 10, suspended vanners; 11, vacuum filter; 12, zinc boxes; 13, tube mill; 14, Card concentrators; C^1, C^2, C^3, C^4, C^5, Ovoca classifiers; G, centrifugal pumps; O, sand leaching tanks; S, slime settlers; SC, slime cyaniding tank; SB, bromocyanide tank; SS, filter storage tank; P, clarifying presses; K, separating cone.

In some cases, of which the Independence is typical, a fine, granular product is desired for concentration efficiency, while in other instances, typified by the total-sliming mills, the highest economy is secured by producing an extremely fine product as quickly and simply as possible. In the latter case the chilean mill has been able to prove its adaptability, and when construction includes the Mantey offset I should be inclined to consider the large diameter, slow-speed mill both cheaper and more efficient than the higher-speed mills such as are used at the Independence. In connection with this subject it will be interesting to refer to my article on

chilean mills[1] and also the paper by Walter H. Urbiter[2] on the same subject.

Careful Concentration a Feature

From the chilean mill the pulp is led to the Ovoca classifiers, which are double spiral-screw machines designed by Philip Argall. The milling is done in cyanide solution containing ½ lb. KCN per ton, and from that point the ore is constantly in solution. The Ovoca classifiers give a sand practically free from slime with from 15 to 25% moisture, thus performing the operations of separation and sand dewatering. The sand is sent to 20 Card concentrators. There are 22 installed and the pulp is distributed to the tables by means of an automatic distributor which has been perfected in use at this mill.

The slime from the classifier is thickened in cones and sent to the slime concentration department, which is equipped with 13 Deister tables and four vanners. The Deister slime concentrator here performs equally as good work as the vanners and the maintenance expense is less than one-tenth of that of the vanners.

From the sand concentrators two products are obtained, a high-grade concentrate, which is shipped direct, and a middling, which is reground and reconcentrated. Originally it was designed to treat the concentrate on the ground and a roasting plant for that purpose was erected, but it was finally decided, on account of the character of the concentrate, which is desired by the smelters, to ship it. The concentrate can now be considered as having its gold content definitely recovered as the other elements contained pay all its expenses, leaving the gold net. Under such circumstances it would not be wise to attempt its local treatment.

Higher Value of Finer Material

In the case of the Independence ores it is invariably true that the finest material carries the most gold. The gold occurs mainly in films along the fracture planes or in small cavities, the sulphide in the body of the rock being of low grade and often worthless. It is due to these basic facts that the crushing system in use was devised and followed, it being briefly an attempt to liberate the sulpho-tellurides to sufficient extent that they might be removed by concentration, leaving a sand tailing of low grade that might be lightly cyanided and discarded.

The slime, containing the higher value, is also concentrated as closely as possible and cyanided carefully by more efficient methods. The slime tailing has never been reduced as low as the sand. The guide now chosen is to keep the sand tailing below $1 per ton in value, making a slime that runs in the neighborhood of $2 per ton after concentration. The coarse sand produces a high-grade concentrate, running from five to seven ounces per ton, a middling which is reground, in turn producing rich concentrate and a proportion of slime, and a tailing of extremely low gold content, as has been mentioned. This procedure enables the comparatively coarse crushing to be practiced in the chilean mills and renders obtainable a crushing cost which would be out of the question were total sliming resorted to.

Portland Cyanide Mill, at Victor, Colo.

Sand Leached in Round Tanks

The sand and slime tailings are both pumped to the cyanide plant where a pair of Ovoca classifiers separate them finally, the sand being moved by a special conveyor into the sand-leaching tanks. This conveyor is the usual "grasshopper" type, a long bar, supported on wheeled trucks, having a number of hinged pusher blades working in a trough or launder. The launder is arranged so that openings can be made into each tank at several different places. The sand is distributed practically automatically, the final leveling of the top of the tank being about the only hand labor required. A stream of solution is led into the tank along with the sand, which is so free from slime that no trouble with channeling or segregation of slime is experienced.

[1] "Eng. and Min. Journ.," Nov. 12, 1910.
[2] "Eng. and Min. Journ.," Aug. 5, 1911.

The sand thus laid into the tanks is treated with ½-lb. cyanide solution for four days and is then sluiced out and run to waste. The sand treatment is extremely simple; but since the precious-metal content is small, the economical maximum of extraction is reached in this way.

Slime Treated with Bromocyanide

The separated slime from all departments is led into four continuous thickening tanks, the products being a clear overflow and a thick slime which is pumped into a treatment tank where it receives a six-hour treatment with ¾-lb. cyanide solution, and afterward a four-hour treatment with bromocyanide in a separate tank. The bromocyanide treatment is in accordance with the general practice, the solvent being made from the usual "miners salt" in the ordinary way. The only departure from generally accepted practice is that it is found necessary to maintain a comparatively high alkalinity during the treatment, general practice insisting on a neutral solution in most cases.

The tanks used for agitation are a special design, the features of which are a pointed cone bottom and a cylindrical section of little height, a central agitation pipe, into which air is admitted at the bottom, and having a cone over its outlet, which is in about the middle of the vertical height of the tank. The cone is open, with its vertex pointed down and is designed to spread the outcoming pulp over the area of the tank. It is simply another method of taking advantage of pneumatic agitation, the variations of which are without number. The accompanying flow sheet shows the movement of pulp and solution and the machinery installed. There is little novelty in the methods used in cyaniding the concentrate tailing.

The pulp is fed from a storage tank into a vacuum filter of the stationary or Butters type, in which the leaves are fixed and the movement is of pulp and solutions. This filter is built after the Cassell design and was one of the first of the kind to be used. It shows its early construction, but is still doing efficient work. The leaves are made of canvas with a filling of cocoa matting, and are stitched with wire instead of the usual thread. This is said to prevent ripping and obviate a large portion of the usual repair bills. Solutions for precipitation are clarified by passing them through a filter press of the plate-and-frame type.

Precipitation by Use of Zinc Shavings

Precipitation is in the ordinary manner by the use of zinc shavings. There is little difficulty with the operation. The barren solution produced is used first on the concentration tables as wash. The precipitate is not melted or refined at the plant, it having been proved more economical to ship it to smelters for final treatment. The precipitate is thoroughly dried, sampled and sealed up in cans for shipment. The fact that precipitate of this class can be shipped at a less cost than treating it on the ground is worthy of comment, for it is generally considered better practice to handle it at the plant, where there is less chance for loss due to differences of sampling, to say nothing of transportation charges. This matter ought to be investigated, particularly by plants situated conveniently to smelting installations, as I believe that generally no investigations are seriously made, it being taken for granted that treatment on the ground is cheaper.

Extraction and Consumption of Material

The extraction totals 71.5% of the content, of which 43.65% is obtained by concentration and 27.85% by cyanidation. The consumption of chemicals is about 0.45 lb. of NaCN per ton, 0.3 lb. of zinc, 2.2 lb. lime and 0.4 lb. of the bromine salt. The mill consumes about 320 hp. and employs 35 men regularly in the operations. The costs are moderate for the method followed and are shown in the accompanying table.

The Barytes Industry of Cole County, Mo.

By F. C. Bryant*

Barytes has been mined in this country since 1866, when one Turner erected a water-power plant on the Osage River where the town of Henley now stands. Turner refined the barytes and shipped it to St. Louis by boat, where it sold at $120 per ton. Turner operated his little plant for about 15 years, by which time the price had decreased to $60 per ton, when he sold out his store, and the queer old barytes mill went to wreck. The mines, however, from which he received his raw ore are still producing. One of them, now known as the Bryant Barytes-Lead Mining Co., has the first steam mill ever erected for concentrating barytes, or "tiff," as the ore is locally termed.

Three Important Properties

The Bryant Barytes-Lead Mining Co. erected a 150-ton plant of the Joplin type, on this old property during the winter of 1911-12. The mill was started early in the summer but lost considerable time, owing to difficulty in disintegrating the red clay which invariably accompanies the barytes. After considerable experimenting this was finally accomplished, and the mill has been running since on the dump from the old mine. These dumps contain about 300,000 tons of material averaging 25% barytes and ½% lead.

The material is scraped from the dumps to an ore hopper by the use of a double-drum engine and a scraper holding one cubic yard. The material is then fed into a trommel washer, 4x10 ft., running 20 r.p.m. This trommel has a hollow shaft through which water is forced against the clay as it is revolved, the oversize going to a 14-in. crusher. Two jigs and one concentrator are used. The mill produces from 30 to 40 tons of barium concentrates per day, and some lead from the table. As stated this is the first and only steam plant in the state devoted to the concentration of barytes, and is a marked success. John Teague is superintendent and 15 men are employed.

The Bryant Mining Co., operating the old Franck barytes mine, one mile south of the Bryant Barytes-Lead company's plant, is using a long sluice and hand jigs, with much success and is producing 15 tons of barium concentrates per day. This is also an old mine which has produced for many years. The present company is working both mine and dump. Considerable lead is recovered

*Mine operator, Henley, Mo.

from this mine, the ore averaging about 1% Pb and 35% Ba. It is the intention of this company to put up a bull jig for roughing the ore, by which means a much larger capacity will be maintained. The ore here is all free and is only crushed to ¾ in. before going to the jigs. Ten men are employed. John Teague is also superintendent of this property.

One mile to the south of the Franck mine is what is known as the Wilson mine, operated by the Finck Mining Co., of St. Louis. This mine has been in operation for 25 years though it has never had a mill of any kind upon it. The ore is mined and carted out on to what is called the tiff bed, where it is allowed to dry, after which the larger pieces are cleaned by hand, of the clay and mud, lead or any foreign material that may adhere to it. The finer stuff is then put into what is called a rattler. This is a sort of screen made on the principle of a squirrel cage, about three feet in diameter and 16 in. wide, ⅝-in.; iron rods with one-inch openings form a screen to let out all the dry dirt. This screen is mounted on upright posts and turned by hand. After rattling the dirt out, the ore is then hand-picked again. This is the only attempt ever made toward a mechanical device for cleaning barytes in this state up to last year. The Wilson mine produces about 60 tons of crude barytes per week with seven men. Abraham Bergan is superintendent.

There are four other small mines in the county that are worked in a half-hearted way. The total production for the last year will likely be larger than for many years. Barytes is commonly found in what are locally called circles, which seem to be chimneys. The three largest mines, the Bryant Barytes-Lead, the Wilson and the Franck mines, are all of large dimensions. The first is a round pit, 250 ft. in diameter and is opened to a depth of 40 ft. The Wilson is 300 ft. in diameter and is opened to a depth of 25 ft. The Franck mine is 275 ft. in diameter and opened 18 ft. deep. These three are all in line, with the Franck mine in the center. The Wilson is a mile to the south and the Bryant Barytes-Lead a mile to the north. All have a superior grade of white barytes which commands the highest price on the St. Louis market, where most of it is sold, though the demand for this particular ore extends to Toronto.

Beginning in 1913 considerable barytes will come into the market as a byproduct from the zinc mines of Cole and Benton Counties, because of the final solution of the long vexing problem of separation of zinc and barytes. There are now two means of making this separation and plants will be in operation early in the spring of 1913. Of this separation it is too early to say more. However,, the Black Jack Mining Co. is now preparing to get its mine into operation in January, as it has a contract to furnish a large tonnage to a St. Louis plant. There are at least four well developed barytes-zinc mines in this section that will be put into operation as a result of this separation. The separation of zinc-barytes ores will mean much to central Missouri counties, as the ore occurs generally in at least seven counties and an increased zinc production will be the result.

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The Average Voltage per Mile for Long-distance Transmission is at present about 750 volts, at which rate the length of transmission would be 200 miles for a 150,000-volt line. There is at present, says E. A. Lof in the "Engineering Magazine," one system with a transmission pressure of 140,000 volts, which is in successful operation, while one for 150,000 volts is under construction. Besides this, a number of systems with a pressure of over 100,000 volts are giving satisfactory results.

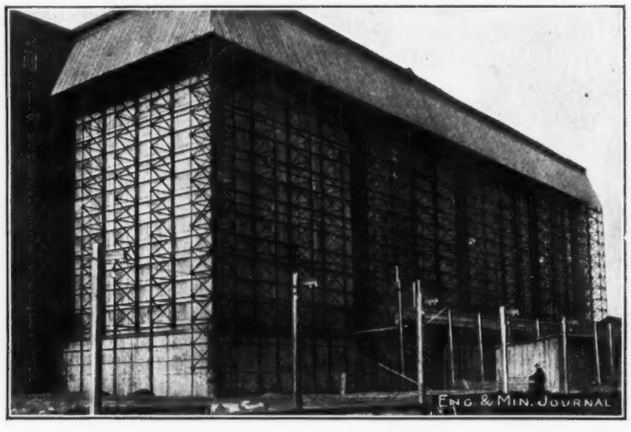
The Falding Sulphuric Acid Chamber

In its simplest form a sulphuric-acid plant would consist only of a generator for the sulphur-dioxide gas and a chamber in which the SO_2 could be mixed with nitrogen oxides, air and water vapor. The sulphur dioxide would be oxidized to sulphur trioxide, and combining with the water would form sulphuric acid, while the reduced and reoxidized nitrogen compounds would pass off in the waste gases.

To recover the oxides of nitrogen, mainly nitrous anhydride (N_2O_3), the Gay-Lussac towers are added at the exit, the nitrous anhydride being absorbed in strong sulphuric acid, and in order to bring it back into the circulation, the so called Glover tower is interposed between the burner and the chamber. In this tower the nitrous anhydride is expelled from its sulphuric-acid solution, by contact with the hot burner gases, while at the same time the gases for the chamber are partially cooled and a partial concentration of any sulphuric acid already formed is effected.

Reacting Space in Ordinary Chambers Is Small

In the ordinary sulphuric-acid chamber through which the gases pass along the horizontal axis, there is a zone

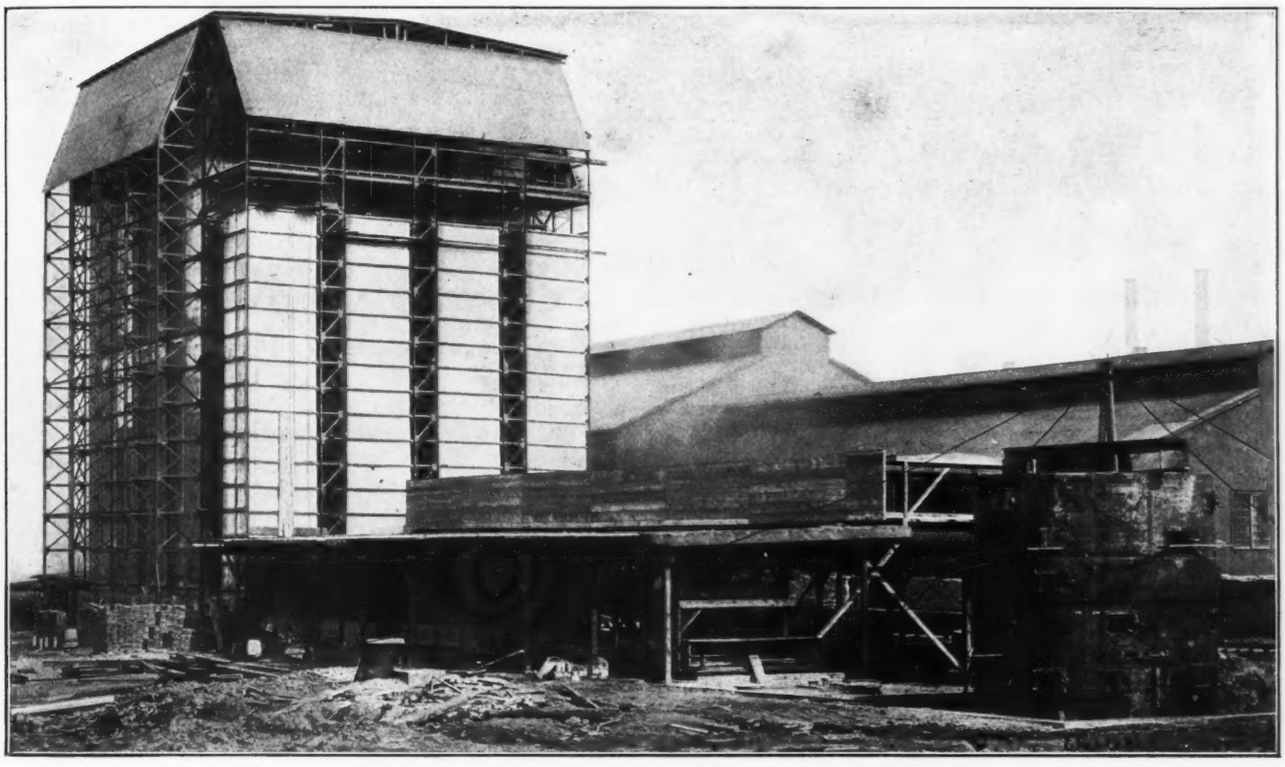


Falding High Chamber at Copperhill, Tenn.

of great activity near the inlet. The intensity of the reaction dies away as the gases go further and further from this inlet, until toward the end of the chamber there is practically no chemical activity. At the same time the reaction has not been quantitative, for there will be unchanged sulphur dioxide present in the gas at the outlet. The gases are then passed through a series of two or more chambers, which are connected by small flues and in each chamber (although with constantly diminishing intensity of reaction due to the progressive elimination of the chemically active constituents of the gas mixture) the same thing is repeated; that is, there is a zone of high activity near the entrance and a zone of practically no activity at the exit, with all graduations in between.

It may be said that, irrespective of the length of the first chamber in a sulphuric-acid plant, all of the active work is performed within the first 30 or 40 ft. of its length, and that reaction will not be resumed until the gases have again been mixed by passing through the small flue. Previous attempts to reduce the loss of unchanged sulphur dioxide in the waste gases, or the amount of chamber space necessary to effect the complete con-

version of the sulphur dioxides, have been restricted to the following four plans: (1) To increase the proportion of nitric oxide to the sulphur dioxide in circulation, thereby increasing the speed of the initial reaction, depending upon the Gay-Lussac towers to recover the increased amount of nitric oxide thus put in the system; (2) shortening the first chamber and passing the gas through cooling and drying apparatus, such as surface of spraying condensers, before admission to the succeeding chamber, thus increasing the intensity of secondary reaction; (3) division of the initial volume of gas to two or more chambers in parallel, instead of in series, with a reduction of the secondary chamber space; (4) the tangential admission of the gas (Meyer system) into cylindrical chambers, working on the assumption that the spiral passage of the gas near the cooled chamber side would accelerate the primary reaction.



FALDING SULPHURIC-ACID CHAMBER, VANDERGRIFT, PENN.

THEORY OF THE FALDING HIGH CHAMBER

The oxidation of sulphur dioxide to sulphur trioxide is a strongly exothermic reaction. Hence the gases which remain hot must be those in which the reaction is still proceeding. By the law of convection, these hot gases will remain near the upper part of the chamber or zone of reaction and only the inert and, therefore, cooler gases will be separated and pass to the lower part of the chamber. In this way, with a chamber designed so that the relationship of height to area and volume of gases admitted is correct, it is clear that quantitative results can be obtained in one chamber. This is the basis of the Falding system.

The gas mixture is admitted at the top of a chamber, the height of which greatly exceeds its horizontal dimensions, consequently convection currents are set up in the gas mixture within it and the reacting gas constantly tends to rise and collect at the top as long as any reaction goes on. The inert, non-reacting, non-heat-producing, and therefore cooler gases, tend to separate and go to the bottom of the chamber.

THE VANDERGRIFT PLANT

A plant along these lines for making brimstone acid was erected for the United States Steel Corporation, at Vandergrift, Penn., in 1906, consisting of a chamber 50 ft. square and 70 ft. high, connected with one Glover and two Gay-Lussac towers, with a small unpacked cooling tower 9 ft. 6 in. square by 50 ft. high before the Gay-Lussacs. The difference in temperature between the top and bottom of the reaction chamber varies from 22° to 7° F., according to the intensity with which the system is driven. Under normal working the gas leaving the chamber does not contain sulphur dioxide. Average consumption of nitrate of soda at this plant is about 2%. For the Tennessee Copper Co., a plant, consisting of a battery of 12 chambers of identical construction with those at Vandergrift, Penn., described above, was constructed, and since these chambers were built, 24 additional chambers have been added. The quality of gas supplied to these chambers fluctuates greatly, owing to dilution of carbon dioxide from the matte-smelting furnaces, so that no tabular statement of the work done here can be given. The Tennessee Copper Co. claims that its net profits are approximately equally divided between the income from sulphuric acid and the income from other sources.

Since the construction of the Vandergrift and Tennessee plants, a plant has been erected for the Cleveland-Cliffs company at Marquette, Mich. The chamber is 50x50x70 ft. high and is provided with a packed cooling

tower and ample Gay-Lussac capacity. New York pyrite fines are used with a Wedge burner. The output is concentrated to 66° Bé. The stipulated capacity of this chamber was 35 tons of 66° Bé. sulphuric acid, which was easily reached. This rate of production is equal to about 8 cu.ft. of chamber space to one pound of sulphur burned. The consumption of nitrate of soda is materially less than 3% on the sulphur burned. A plant has also been erected for the Dominion Iron & Steel Co., Ltd., at Sydney, Cape Breton, Canada, having the same dimensions as above, and a plant has recently been completed at Sault Ste. Marie, Ontario, Canada, for the Algoma Steel Corporation, Ltd., at which the dusty Helen mine pyrite fines are used. The dimensions of this chamber are 35x35x70 ft. high and in addition to the packed cooling tower, the system is provided with a Petersen regulator. At this plant the consumption of nitrate of soda based on sulphur burned is less than 2%, and the utilization of the chamber space is about 6.4 cu.ft. to one pound of sulphur burned.

Construction of the Chamber

The chamber is built upon a slab of reinforced concrete, which is covered with a layer of asphalt, which receives the bottom lead of the chamber. The lead work is suspended from a steel frame in such manner that at no point does the steel come in contact with the lead. The advantages of the chamber are the saving of lead in construction, a comparison with other forms showing 35 to 50% economy in lead used; increased efficiency of chamber space; great economy of ground space and foundation (about 66%); fireproof construction, and saving in amortization, insurance, etc.

The Graphite Industry

By Malcolm McNaughton*

Perhaps no better index of general business conditions in this country can be had than that of the importation of Ceylon plumbago. This material has so many uses in so many different branches of industry, that any general improvement in business is immediately followed by increased importations and advancing prices. The average yearly exportations from Ceylon for the 10 years ending Dec. 31, 1911, were 29,000 long tons; the maximum being 35,000 tons in 1906. The exportations in 1911 were 27,000 tons, while the amount for 1912, based upon figures up to Nov. 25, will amount to something over 32,000 tons. Of the total exportations from Ceylon, the United States ordinarily receives close to 50%, but in 1911 we took only 40%. Whatever falling off there was in exportation during 1911, was due entirely to the decreased demand from the United States. Because of the increased demand during the last six months, prices have materially increased, being approximately 20% higher than in December of last year in those grades which are used in the manufacture of crucibles. The increase in the prices for the lower grades, such as are used in foundry facings and in the manufacture of stove polish, has not been so great; hardly more than 5%. About 70% of the tonnage imported is used for crucible purposes, 15% for foundry facings, 10% for stove polish, and the remainder for various other small uses. Ceylon remains the important source of crystalline plumbago. Nowhere else in the world does the material occur where the conditions are such that it can be mined with profit.

In the United States and Canada are numerous deposits of ore carrying graphite in the crystalline form. Thin flakes of the substance are disseminated throughout the rock, and require an elaborate system of crushing and concentration for their separation. These flakes are extremely thin, while the prepared Ceylon plumbago is more granular in structure. Up to the present time the flake form has not met with general approval for crucible service, and so its use has been limited principally to lubricating purposes. During the last 25 years, nearly 40 projects for the production of flake graphite have been started in this country and in Canada, approximately as follows: Alabama, 6; Pennsylvania, 11; New Jersey, 9; and in Canada, 12 or 15. At the present time three of these may be considered as in full operation, two or three are building, two or three others are being remodeled, while the remainder are in various stages of disuse. These have failed to succeed for various reasons; some owed their inception entirely to the activities of mining promoters, and others have failed because of lack of ore to supply the mill for any extended length of time. In still others a uniform product was impossible, because of varying conditions in the character of the ore, and many failed because of lack of resources and knowledge of market conditions. The capacity of these various mines and mills is eight or ten times greater than the demand at the present time for this particular form of graphite.

Within the last few months, news has been received of discoveries of disseminated graphite (the flake form) in the Island of Madagascar. So far, none of this material has come into the United States, but shipments in considerable quantities have been made into England and France.

Amorphous graphite is imported at the present time from Mexico, Germany, Austria, and Korea. That coming from Mexico enjoys more or less of a monopoly for use in lead pencils, the better grades being selected for this particular purpose. During the last two years, increasing quantities have come in from Korea, of a grade high in carbon, sold at low prices. This particular quality is used principally in the manufacture of stove polish and foundry facings.

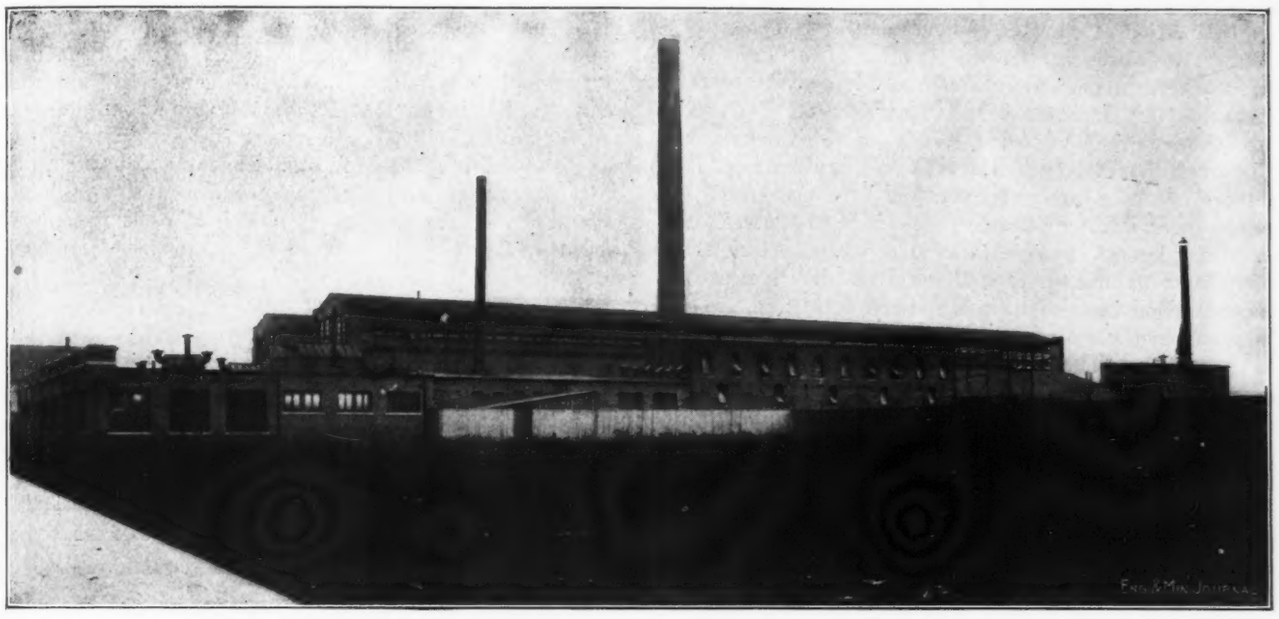
*Joseph Dixon Crucible Co., Jersey City.

Analysis of a Missouri Meteorite

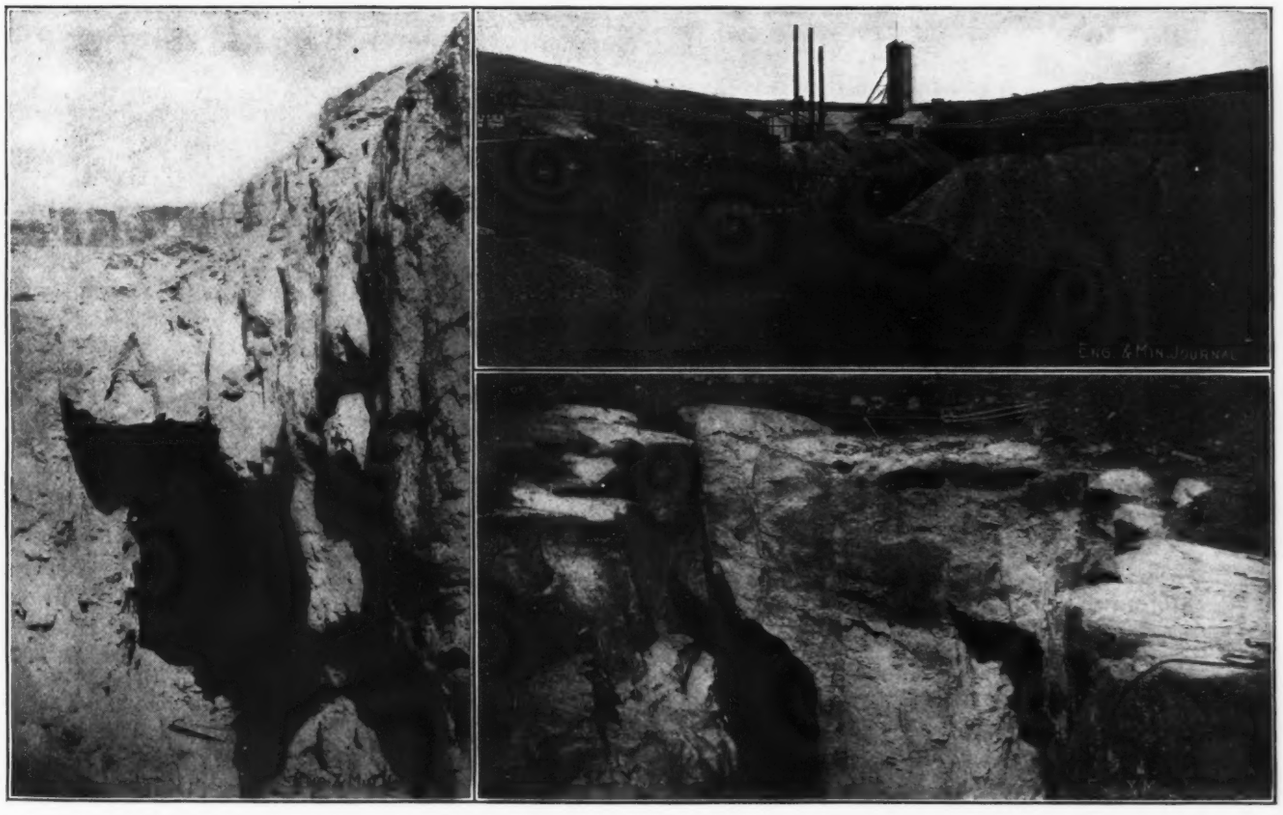
An analysis has recently been made of a meteorite found near Perryville, Mo.: Fe, 89.015%; Ni, 9.660; Co, 0.545; Cu, 0.025; Mn, none; P, 0.365; S, 0.002; Si, 0.003; C, 0.015; Fe_2O_3, 0.370; Ir, Pd, Pt, Ru, traces. This is said to be (*Proc.* U. S. National Museum, p. 595, 1912), the first instance of ruthenium in meteoric iron. The phosphorus seems to exist as schreibersite $(Fe, Ni, Co)_3 P$. The iron is inactive, taking copper, in etching, only slowly and unevenly, sometimes only after an exposure of several minutes, and complete evaporation of the sulphate solution.

Aluminum in Acetic Acid may cause trouble in the basic-acetate separation of iron and alumina. A sample of acil examined by K. Enz ("Apoth. Zeit., p. 942, 1912) contained 0.095 grams Al per 100 grams of acid.

PHOTOGRAPHS FROM THE FIELD



WORKS OF THE MICHIGAN SMELTING & REFINING CO., AT DETROIT, MICH. ONE OF THE LARGEST SECONDARY-SMELTING PLANTS IN THE UNITED STATES



TWO VIEWS OF THE 50-FT. OPEN STOPE OF O'BRIEN MINE; THE TOWN OF COBALT IS SHOWN IN THE BACKGROUND OF ONE OF THEM. THE SHAFT AND DUMPS OF THE VINDICATOR MINE, CRIPPLE CREEK DISTRICT, ARE SHOWN IN THE UPPER RIGHT-HAND PHOTOGRAPH

Transportation and Deposition of Gold

How gold is dissolved and transported by underground waters is not definitely known, writes Victor Lenher, in *Economic Geology*, Vol. VII, No. 8. The suggestive work of Stokes on its solubility in cupric chloride or in ferric-chloride solutions at 200° with the redeposition of metallic gold on cooling, appears to afford a possible means of transportation at elevated temperature and deposition by temperature lowering. The agency of manganese in gold solution and transportation is consistent in many observed instances, but requires, for the first solution of the gold, free chlorine or some other solvent of equivalent power. The solubility of gold in the alkaline cyanides is of little importance in nature. Its solution by concentrated sulphuric acid, strong phosphoric acid in the presence of oxidizing agents, hydrochloric acid under pressure and nitric acid at atmospheric pressure requires a degree of concentration impossible in a natural solution. Precipitation from these acid solutions is assumed to take place by ferrous sulphate, metallic sulphides, such as pyrites, or by a temperature lowering.

In connection with some recent chemical studies, it has been developed that certain solutions of gold are much more stable than would be generally supposed. Alkaline solutions have never received the same attention as the chloride solutions; particularly is this true of the alkaline sulphide solutions. It has been shown that spongy gold is soluble in alkaline sulphides and that sodium sulphide will dissolve gold dust, and it is significant that the gold from these alkaline sulphide solutions will not be thrown down by iron pyrites, nor by metallic iron, but will deposit out by exposure to the air, which oxidizes the sulphide, or on contact with acid; whereas from the chloride solution the metals, metallic sulphides and many kinds of organic matter will precipitate the gold. Indeed, it has been demonstrated that sodium, potassium, ammonium or calcium solutions will dissolve gold leaf in sealed tubes in the presence of pyrites with no deposition of gold whatever on the latter.

It is, therefore, obvious that gold, held thus in solution, could be transported without precipitation through a bed of pyrites, and if the latter were gold bearing, the solution might actually be enriched. It could be deposited by meeting acid or on entering a zone of oxidation.

A double thiosulphate of gold and sodium can be formed by sodium thiosulphate acting on gold in the presence of oxygen, or on auric chloride alone. This salt possesses remarkable stability, in that it is decomposed only slowly by dilute hydrochloric or dilute sulphuric acids or by such common precipitating agents for gold as ferrous sulphate and oxalic acid. These thiosulphate solutions are also reasonably stable in the presence of pyrites, which, however, on standing, will accumulate a gold deposit.

The double sulphite of gold and ammonium in solution is quite stable to metallic iron and iron pyrites, but the sodium and potassium double sulphites with gold, are unstable to pyrites and mixed with the ammonium gold sulphite, render it also unstable. This would seem to render these solutions unavailable as means of gold transportation in nature, where the sodium and potassium salts are more common than the ammonium.

Gold in the aurous state is produced with difficulty. Aurous chloride and bromide are formed in the laboratory by the action of moderate heat on auric chloride or bromide. By proper control, sulphur dioxide can reduce auric gold to the aurous state. Sulphurous acid usually effects complete reduction of an auric salt to metallic gold, but in the presence of a large excess of magnesium, zinc, calcium or alkaline chlorides, reduction by sulphurous acid can be stopped at the aurous state. Auric chloride, thus reduced, probably exists as a double aurous chloride. Such aurous solutions are stable out of air contact and in the presence of little free acid. When exposed to air, precipitation of gold takes place, probably by auto-reduction by the oxygen of the air. Out of contact with air, the aurous solution is far more stable to pyrites than the auric and might be a means of natural transportation.

Of the various means of gold solution and transportation observed, the alkaline sulphide solutions mentioned would appear to solve some of the problems of gold deposits.

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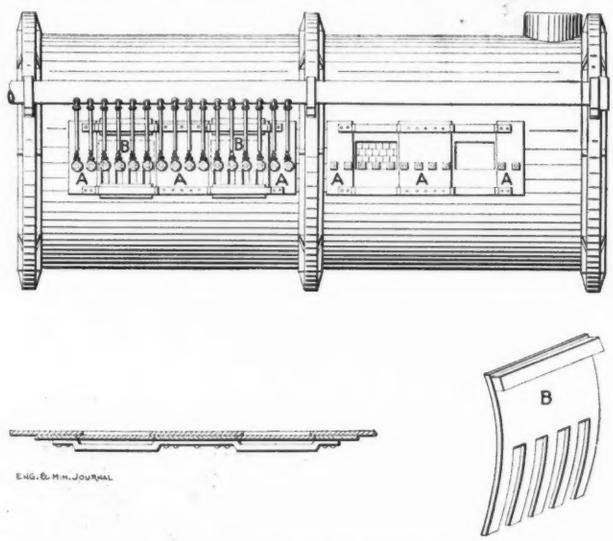
Repairing Converter Linings

A recent invention of E. A. C. Smith, of Baltimore (U. S. pat. No. 1,044,587), provides a means of making repairs around the tuyere zone of a converter. The lining in the tuyere zone consists of bolted sections alternating with removable plates, the bolted sections being marked *A* in the illustration. Straps are fastened at the top and bottom of these sections and clear the converter at intermediate points so as to permit of removable plates *B* being slipped down, back of them. These plates are then wedged into place. It will be noted that these plates are made fork-like so as to slip over the cast-iron tuyeres.



Scheme for Repairing Converter Linings

In case the break in the lining comes under a removable plate, it is immediately accessible; if it comes under one of the bolted sections, the two adjoining removable plates are taken off. By means of this method of making repairs the long delay necessary to cool one of the large basic converters is avoided, and repairs can be made immediately. The mechanics on the repair job can work at higher efficiency, also, as they are not exposed to the comparatively high temperatures which exist in a converter even after it has stood for many hours.

DETAILS OF PRACTICAL MINING

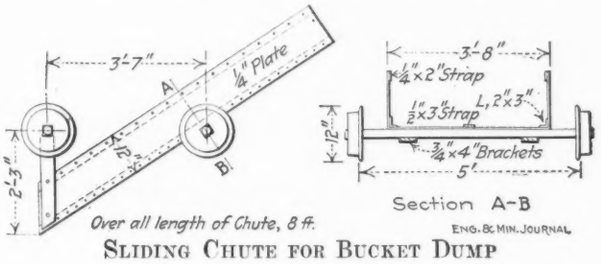
Sliding Chute for Shaft Sinking

By L. D. Davenport*

The accompanying drawings show a sliding chute in common use in the Lake Superior iron country during shaft-sinking operations.

The apparatus is operated by one lander as follows: The sinking bucket is hoisted just high enough to clear the rear end of the chute, the latter is then pulled back under the bucket until the wheels strike the crosshead guides. The bucket is then dumped into the chute and the dirt and rock run into the tram car below. The chute is then pushed ahead clear of the shaft and the bucket is lowered. With a little practice, this operation is done quickly. The chute is sufficiently long so that in case the bucket gets away from the lander and dumps backward, as sometimes happens, no dirt falls into the shaft.

The chute is eight feet long over all and is built of ¼-in. iron plates stiffened with iron straps. The side plates



Sliding Chute for Bucket Dump

are fastened to the bottom plate with 2x3-in. angles riveted as shown. The front end is 1 ft. 9 in. below the rails which carry it and about one foot above the top of the tram car at the shaft collar. This brings the chute track about seven feet above the collar of the shaft.

Timber is brought in at the opposite side of the shaft from the tram car and since the gage of the chute track is the same as the distance between the dividers, five feet, there is plenty of room.

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Rapid Method of Coloring Drawings

By H. P. Bowen*

Every draftsman has had occasion at one time or another to color a drawing or a white print. The use of colored inks is unsatisfactory; cross hatching in colors obscures the details and is slow, while water colors have the disadvantage of slowness besides being difficult to apply evenly.

A quick and satisfactory method of coloring involves the use of ordinary wax crayons and gasoline. Crayon of the color desired is applied and then rubbed with a piece of cloth, wet with gasoline, until the color is even, and extended to the limits desired. If it overruns the lines, it can be erased with a pencil eraser. The crayon should be rubbed on lightly, but not necessarily uniformly. Some colors, particularly the yellows, purples, greens and light blues, produce much better results than others. It is probable that the gasoline dissolves the wax from the crayon, leaving the pigment as an impalpable powder, which, when rubbed over the paper, colors it uniformly. The method is applicable with equal success to egg-shell and smooth drawing papers and to white prints on both paper and cloth.

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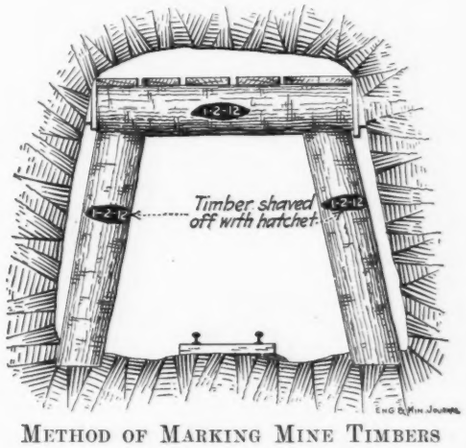
A Method of Recording Mine Timbering

By John T. Fuller*

The method of posting mine timbering to be described refers especially to "gangways" or drifts, but can easily be extended to embrace all timbering, such as shafts,



Method of Marking Mine Timbers

slopes, loading boxes, etc. The timbering in a large mine is one of the most difficult things of which to keep accurate track. The timber in any particular tunnel is put in, as a rule, at different times as the work progresses; retimbering is perhaps of frequent occurrence and the age of the timbering or of any particular set of timber, the cause of failure and many other items of information that are of value to the mine manager, soon become hopelessly confused and lost.

The method of computing the cost of timbering at many mines is simply to charge against this item the timber sent underground and the labor involved in preparing and setting the same. Where the timbering and retimbering in a mine is done by contract and payment made once a month or once a fortnight it becomes absolutely imperative both in fairness to the company and to the contractor to adopt some system of recording or posting the "timber sets."

*Engineer, Oliver Iron Mining Co., Mesaba, Minn.
*Miami Copper Co., Miami, Ariz.
*Consulting engineer, Honesdale, Penn.

Unless some good system is in effect both the contractor and the head timberman, or other company men in authority, are apt to become confused and uncertain as to exactly what timbers have been set during the period in question. Especially is this true in the case of re-timbering, which frequently means simply re-setting timbers at irregular intervals.

A scheme that I once tried, was to have a special set of tracings made of each level in the mine. When the engineers posted the development work at the end of each period they also posted the timbering with the aid of the head timberman. Each set was then plotted on the tracings in its proper place.

As far as keeping track of the new timbering was concerned this plan was a success, but in trying to keep the re-timbering posted in this way, the tracings soon became hopelessly confusing. This fact, together with the amount of extra work thrown upon the already overworked engineering department, led to the abandonment of this scheme as impracticable.

The problem was finally solved as follows: A set of 11 steel figures, including a spacer, was ordered. Every stick of timber in the mine after being set in position was blazed with an ordinary carpenter's hatchet and the date of setting punched thereon with the steel figures, and then painted over with one coat of a wood preservative paint as indicated in the accompanying drawing. In the drawing the blaze mark and the date are exaggerated for the sake of clearness.

The head timberman on his final round just before the end of the shift, took with him, in a canvas bag slung over his shoulder, the steel figures required to mark the date of that day, a small hatchet, about two pints of paint in a specially stoppered can, a brush, pads of the "Retimber Sheet" form, the character of which is shown herewith, and of another form called the "Timber Sheet" in which the columns marked " Date of old timber put in" and "Life" are omitted and the heading of the last column "Cause of Failure" is changed to "Remarks." He blazed and marked each timber as shown and entered the required data on the proper form, leaving blank columns which are headed "Cost of Timber," "Labor Cost Erection," "Total Cost" and "Life." Before going to the next level he would leave the filled-out forms at the toolhouse, where at the end of each shift the timekeeper found and collected them. The timekeeper filled out the column marked "Labor Cost Erection" and checked the labor items. On reaching the surface the timekeeper turned the forms over to the storekeeper, who filled out the "Cost of Timber" column and returned the forms to the timekeeping department where the remaining columns were filled in, the whole sheet checked over and placed before the mine manager before the miners and other workmen in the mine coming off shift had changed their clothes and left the mine. It was thus possible for the manager to check up any questionable report with the head timberman and the men who had performed the work before any appreciable time had elapsed since its completion.

The sheets were kept on file by levels. The various items as shown by the sheets were posted and totaled daily by the book-keeper on the large mine-cost sheets, so that the end of a period entailed no extra work to find the amount due the contractors or the cost of the mine timbering.

The date mark placed on the timbers in the way described will remain clear and legible as long as the timber lasts. Old timbers reset were marked a second time, leaving the original marks intact so that when a set of timber was finally removed the individual pieces forming the set practically told their own history and age. Where the timbering is done by contract the columns headed "Labor Cost of Erection" are designated as "Cost of Contract" with subheads; "Sets," "Feet," "Rate" and "Cost."

RE TIMBER SHEET — Sheet No. 1

Level ..... Date ..... Shift .....

Location	Caps		Posts		Sills		Cost of Timber		Labor Cost Erection				Total Cost		Date Old Timber Put In	Life	Cause of Failure
	No.	Dimension	No.	Dimension	No.	Dimension			No.	Rate	Cost						
						Lagging											
						Wedges											

Head Timberman ..... Chief Time Keeper ..... Store Keeper .....

ENG. & MIN. JOURNAL

FORM FOR RECORDING MINE TIMBERING

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The Hydropulsor—A Rotary Hydraulic Ram

There have recently beeen installed in Germany for irrigation, drainage, etc., according to *Eng. Review,* Jan. 15, 1913, pumps of a new type called hydropulsors. The pressure hydropulsor resembles the hydraulic ram in that the power of a falling column of water is used to raise part of the water against a higher head, while the rest is discharged. The suction hydropulsor is similar mechanically, but the power of the falling water is employed to raise outside water from below, the latter being discharged with the actuating water at the level of the machine. Mechanically the machines resemble turbines. There is a runner wheel with curved blades, which is kept in motion by the incoming or pressure water; the chambers of the wheel are alternately connected to the delivery pipe and to the discharge in the case of a pressure hydropulsor and to the suction and discharge in the case of the suc-

tion type. A number of supply pipes are usually arranged radially to insure smooth running and a flywheel is added to the small sizes for the same purpose. Machines of both the horizontal and the vertical type are built and they will operate under heads as low as 18 in., thereby showing a great advantage over turbines. A great range of sizes is possible. The pressure type has been built to deliver against 100 ft. of head and a recent test showed it possible to deliver against a head of 345 ft. with a driving head of 10 ft. only. The number of supply pipes varies from eight to 40, and installations are under way with supply pipes of 30 in. in diameter, having a capacity of 2120 cu.ft. per sec. The principal field of the machine would seem to lie in the draining of marshes diked off from a river and in irrigating land where only low hydraulic heads can be obtained.

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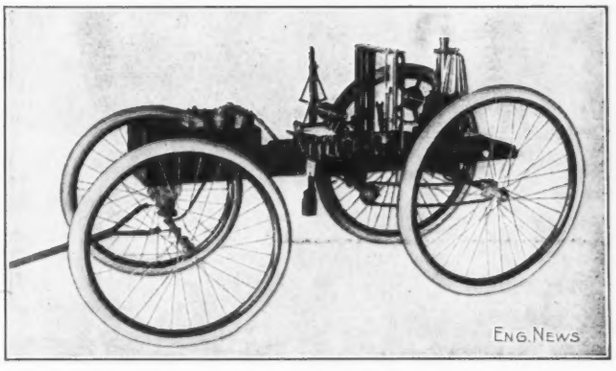
Dykeman Mechanical Surveyor

An automatic level-man and profile draftsman has been invented and patented by M. J. Dykeman. It is an instrument, says *Engineering News,* which only needs to be hauled over the route whose profile is wanted, when it not only turns out a profile drawn to scale and stationed, but also deposits at suitable intervals along the line properly marked stakes. It is shown in the accompanying illustration and is made by the Dykeman Surveyor Co., of Detroit, Michigan.

The working parts of the instrument are mounted on a



THE DYKEMAN MECHANICAL SURVEYOR

light road-vehicle body, fitted with pneumatic-tired wheels for smooth riding. A drive from the rear axle moves a strip of profile-paper over two drums, and also moves a pencil, whose direction of travel is transverse to the motion of the paper. When the vehicle is drawn along, the strip of paper moves horizontally with a speed proportional to the velocity of the vehicle, and the pencil moves vertically over the paper. The rate of movement of the pencil is controlled by a pendulum, which by means of a cam affects the train of friction disks driving the pencil; the result is that the pencil moves vertically at a speed proportional to the vertical ascent or descent of the vehicle, i.e., proportional to the product of vehicle speed and roadway gradient. By the same means, the speed of travel of the paper is so controlled as to represent at all times the horizontal component of the vehicle's motion. A station mark is automatically stamped on the paper at suitable intervals.

A stake-setting device is placed directly behind the profile recorder and, like it, is driven by a chain and sprocket connection to the rear axle. By means of a 60-lb. spring and a trigger, controlled by the station marker, a small steel stake is projected into the ground simultaneously with the marking of the station on the profile sheet.

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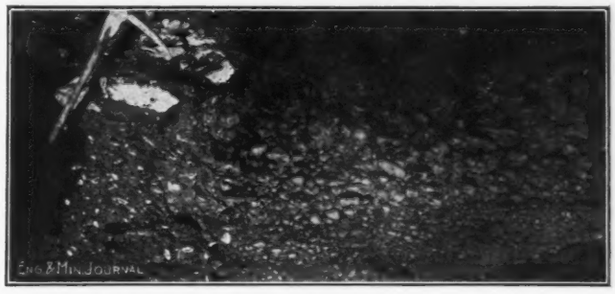
Mining without Timber in the Yukon

BY HENRY MACE PAYNE*

Over a large area in the territory adjacent to Dawson, Yukon Territory, the ground is frozen to an indefinite depth. The gold-bearing material consists of the lower portion of the gravel and the upper portion of the bedrock, along the old "white-gravel channel" or former bed of the streams.

Where the gold-bearing material lies beneath an overburden of muck, sand and gravel, so thick as to prohibit dredging, the usual practice is, if the ground is thawed, to opencut the overburden; or if frozen, to sink a shaft. When the proper depth has been secured, tunnels are driven from opposite sides of the shaft, up and down the creek, or along the axis of the white-gravel channel. After these tunnels have progressed about 15 ft. in each direction, the longwall face is started, and continually advanced until the limits of the excavation are reached, which are usually about 75 ft. on each side and 125 ft. front and back, from the shaft.

Crescent-shaped pillars are left on each side of the shaft until the last, when as much of them is removed as safety will permit. The men work on alternate sides,



BEDROCK AND FROZEN GRAVEL IN A YUKON MINE

from day to day, the thawing being accomplished by steam points during the preceding 24 hours, on the side opposite to where the men are working.

At the Barrette mine, on Hunker Creek, 10 miles above Dawson, the shafts are 40 ft. deep, with frost line one foot from the surface, leaving 39 ft. of frozen material for roof. The engraving shows the gold-bearing gravel grading up into the finer gravel and sand, toward the top, and the broken bedrock at the bottom.

When one of these rectangles, the area of which is about 37,500 sq.ft., is nearly worked out, another shaft is sunk, 250 ft. ahead of the one in use, and the same process repeated. Between these rectangles a 2-ft. frozen barrier pillar is left, partly to support the overhanging arch and partly to hold any drainage water which might subsequently come in the abandoned shaft.

The operation of mining consists simply of picking the

*Mining engineer and chief of staff, Stephen T. Williams & Staff, 50 Church St., New York.

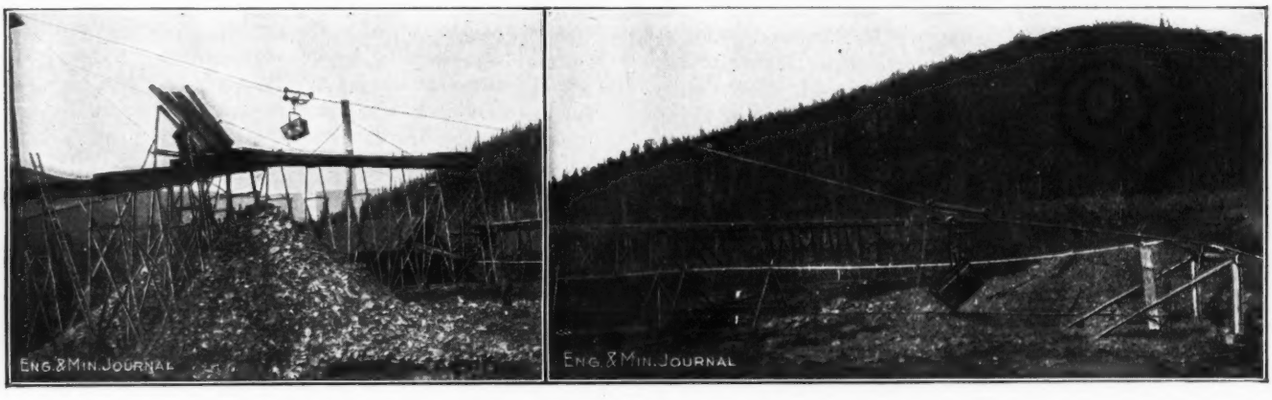
material loose and wheeling it in wheelbarrows to the foot of the shaft, where it is dumped into the bucket and hoisted, as shown below, to the head of the sluice box above the riffles. Here the dumpman, between hoists, forks out the large boulders on the tailing pile below, while the gravel and ore are washed over the riffles and out to the dump. The wages paid the miners are from 60c. to 70c. per hour and they feed themselves, or men living in the company mess house are charged $2 per day for board.

The steam points are placed three feet apart and driven horizontally into the material to be excavated, to a depth of 10 ft. Two men attend to running the boiler and driving the points. About 10 miners are employed and they average 3500 to 4000 cu.ft. per day of 10 hours. Two men will sink and timber one of these small 40-ft. shafts in one week.

The power equipment of the plant consists of a 20-hp. hoist, a 30-hp. engine for the pump, and a 50-hp. boiler. During the winter months, when it is impossible to wash the ore, it is mined and placed in a dump, to be washed the following summer.

TABLE I. RELATIVE TOUGHNESS OF ROCKS AND ENERGY REQUIRED FOR FRACTURE

Kind of Rock	Relative Toughness (limestone = 1)	Foot Pounds per Sq.Ft. of Fracture
Fresh diabase	3.0	624.9
Pyroxene quartzite	2.7	562.4
Sandstone	2.6	541.6
Altered diabase	2.4	499.9
Fresh basalt	2.3	479.1
Hornblende schist	2.1	437.4
Diorite	2.1	437.4
Hornblende granite	2.1	437.4
Rhyolite	2.0	416.6
Quartzite	1.9	395.7
Biotite gneiss	1.9	395.7
Augite diorite	1.9	395.7
Altered basalt	1.7	354.1
Feldspathic sandstone	1.7	354.1
Gabbro	1.6	333.2
Chert	1.5	312.4
Calcareous sandstone	1.5	312.4
Granite	1.5	312.4
Slate	1.2	249.9
Peridotite	1.2	249.9
Granite gneiss	1.2	249.9
Andesite	1.1	229.1
Limestone	1.0	208.3
Mica schist	1.0	208.3
Amphibolite	1.0	208.3
Dolomite	1.0	208.3
Biotite granite	1.0	208.3
Augite syenite	1.0	208.3
Hornblende gneiss	1.0	208.3



SURFACE PLANT OF A YUKON GRAVEL MINE

The Breaking Qualities of Rocks

A list of some of the more common rocks arranged in order of their toughness, with quantitative expressions of their resistance to breaking, together with figures showing the energy necessary for fracture, is given herewith in table I. The list was prepared by Dr. Walter O. Snelling from data given by E. C. C. Lord in Bul. 31 of the Office of Public Roads, Department of Agriculture. (*Proc.*, Eng. Soc. West. Penn., Vol. 28, No. 8.)

It is a common belief that the acid rocks are harder to drill and easier to break than the more basic types. Particularly refractory formations are sometimes described as drilling acid and breaking basic. As a matter of interest, we have taken from table I the typical and unaltered igneous rocks and arranged them in order of their toughness in table II, and to this added figures giving their acidity. These figures for acidity are expressed in the percentage of silica present and are averages taken from analyses published in "Kemp's Handbook of Rocks." The figures cannot be taken as more than approximate, as in some cases, one or two analyses only were available. In the first column the rocks are arranged in order of increasing acidity and should correspond with the second column, where they are arranged in order of decreasing toughness. The correspondence is only rough, if it exists at all. Diabase, basalt, diorite and biotite granite occupy about their proper positions,

TABLE II. COMPARATIVE ACIDITY AND TOUGHNESS OF IGNEOUS ROCKS

Rocks in Order of Increasing Acidity	Rocks in Order of Decreasing Toughness	Relative Toughness	Approximate % of Silica
Peridotite	Diabase	3.0	49
Diabase	Basalt	2.3	51
Basalt	Diorite	2.1	54
Augite diorite	Hornblende granite	2.1	73
Gabbro	Rhyolite	2.0	71
Diorite	Augite diorite	1.9	51
Andesite	Gabbro	1.6	51
Rhyolite	Granite	1.5	71
Granite	Peridotite	1.2	36
Biotite granite	Andesite	1.1	62
Hornblende granite	Biotite granite	1.0	71

but the extremely basic peridotite is one of the easiest to break and other discrepancies are evident.

It would seem that other considerations than acidity influence the toughness of the rocks. The long crystals of hornblende in hornblende granite would naturally prove a better binding material than biotite. An excess of one class of material, as in peridotite, apparently results in a weak rock. Texture is probably more important than chemical composition and the presence of a certain amount of quartz, binding the other minerals together, would tend to make a rock tough, a fact which will be indorsed by anyone who has tried sledging a boulder run through with quartz stringers.

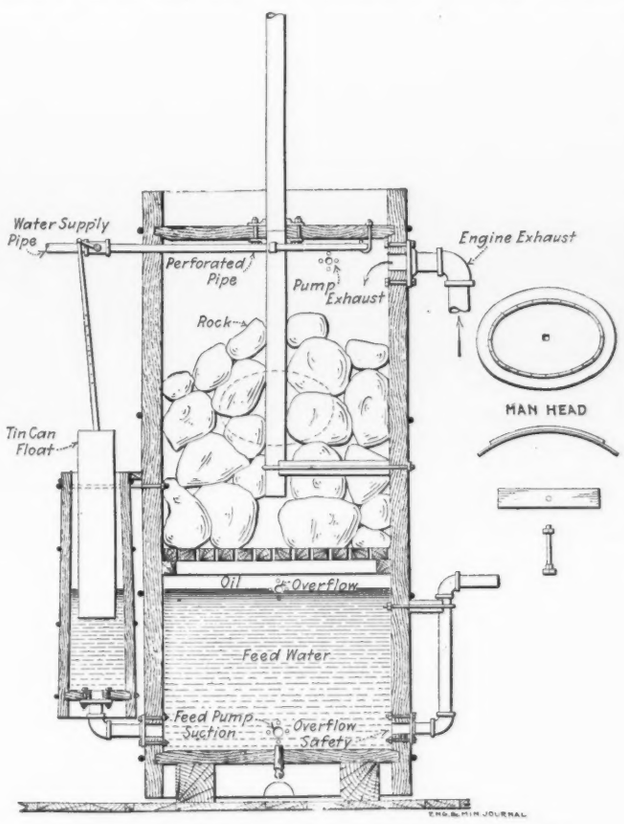
DETAILS OF METALLURGICAL PRACTICE

Simple Feed Water Heater

By Alvin R. Kenner*

In the accompanying engraving is shown a feed-water heater used at the Rio Plata mill, Guazapares, Chihuahua, Mex., which has proved highly efficient. Its cost is so small and its construction so simple that it will soon pay for itself no matter how cheap fuel may be.

The heater is of the open type, the exhaust steam and feed water coming into direct contact with each other. The



Feed-water Heater Used at Rio Plata Mill

exhaust both from the engine and the feed pump enters near the top of the heater and comes in contact with a spray of water discharged from a finely perforated spiral curved pipe which has the large heater exhaust pipe as the center of its spiral. The condensed steam and heated water fall down over rocks to the bottom of the heater. The oil naturally remains on top of the water and the feed-pump supply is taken three or four inches from the bottom. The amount of water which enters the heater is automatically controlled by means of a butterfly valve governed by a float, so that the heater requires no attention whatever. The temperature of the water delivered to the boiler varies between 200 and 210° and at times has necessitated a jet of cold water near the feed pump to keep the feed from vaporizing.

The heater is built of 3x6-in. material and for a 75-hp. boiler, the size should be about 14 ft. in height by four feet in diameter. The lumber required should not exceed 1000 b.ft. A good size for the hoops is $\frac{5}{8}$-in. rod iron and for the can float $\frac{1}{16}$ or Russian iron. The float tank is made slightly larger at the bottom than at the top and the hoops are driven on. The rod between the butterfly valve and float is adjustable. Two-inch piping can be used throughout with the exception of the exhaust which should be 10 or 12 in., and of lighter material. A manhole is placed just above the middle of the heater to facilitate the handling of the rocks which are placed on a 2-in. perforated bottom resting on strips nailed around the tank. A simple form of man-head is shown in the drawing.

It has been found that the heater acts more or less as a water purifier since scale collects on the rocks to a thickness of a half inch or more. Hard, well rounded, river-bottom rocks about the size of an ordinary watermelon should be used where possible, as a soft rock cracks and disintegrates when subjected to the action of the heated water. The rocks should not be piled too closely around the bottom of the exhaust pipe.

There is practically no back pressure in the heater as the cold water condenses the steam and tends to form a vacuum. When the water-supply valve is wide open there is often a suction at the top of the exhaust from the heater. The safety overflow pipe and the float are so regulated that the surface of the water is always maintained at the level of the oil-overflow pipe and once a day the film of oil which has collected is run off. The oil may be filtered and re-used.

The objection to an open heater is the danger of oil passing into the boiler with the feed water. As is generally known, oil in the exhaust steam after condensation exists in two forms, one of which rises readily to the surface while the other remains in fine suspension or in the form of an emulsion. The latter is often the source of annoyance in open feed-water heaters, especially when a poor feed-water heater utilizes all the water from the condensed steam, which having been distilled or vaporized contains no mineral or vegetable matter to cause the formation of scale. This advantage is lost when using a closed heater and for that reason, unless water is plentiful and fairly pure, the open heater is to be preferred.

The danger from oil passing into the boiler is often overestimated and the burning or "blistering" of plates or tubes is not apt to take place unless regular cleaning is neglected. Oil has often been charged with the damage when it was due entirely to accumulated scale. However, there is no question but the minute quantity of oil in suspension may cause trouble under certain conditions, but there has never been the least difficulty experienced in this respect at Rio Plata. C. E. Ballow, who built the heaters, is authority for the statement that no trouble has ever been encountered, although he has used them at sev-

*General superintendent, Rio Plata Mining Co., Guazapares, Chihuahua, Mex.

eral different places with feed waters containing widely varying amounts of vegetable and mineral substances.

Where the suspended oil is likely to cause annoyance an oil filter in the lower part of the tank would minimize the trouble. If the scarcity of water and cost of fuel justify it, the oil may be entirely removed by globulizing it with a current of electricity as in the Halvor Breda system.

Ore Bin Chutes in Rand Mills

In most of the large gold mills on the Rand the ore is fed from the bins to the mortar-box through a gate provided with a chute generally set at an angle of 40° from the horizontal. The door proper at the ore bin is merely a sliding gate lifted by rack and pinion, or by hand, and the chute may be of wood, as shown in Fig. 1, or of steel, as shown in Fig. 2. In either case, states C. O. Schmitt in "A Textbook of Rand Metallurgical Practice, Vol. II," the chute is lined with steel plates, easily renewable, and is provided with a removable cover, unless it is left open altogether.

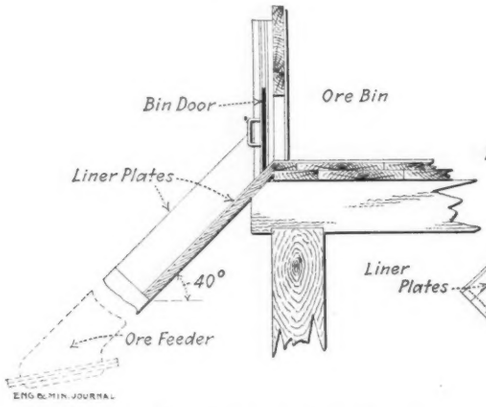


FIG. 1. WOODEN ORE-BIN CHUTE

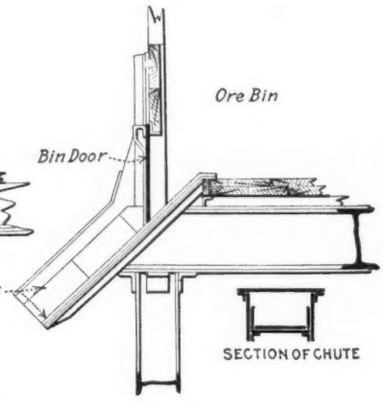


FIG. 2. STEEL CHUTE

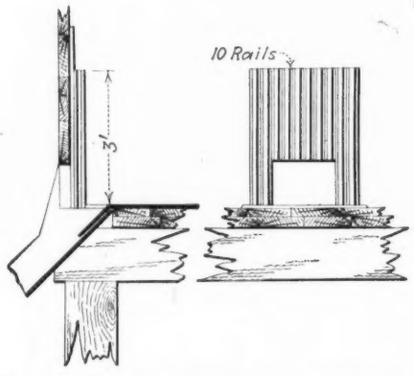


FIG. 3. PROTECTING ORE BIN AGAINST WEAR AT DOORS

Considerable wear results from the flow of the ore through the opening in the bin, and the bin lining is, therefore, protected by steel plates or rails all around the opening as shown in Fig. 3. The control of the amount of ore fed to the stamp battery is not effected by the bin door, the latter being generally set by hand to give somewhat more than the quantity of feed required, while the actual regulation is done by an automatic ore feeder.

Flotation vs. Table Concentration for Copper Ores

In the annual report of the Minerals Separation, Ltd., recently published, the advantages claimed for the company's process in the treatment of copper ores are presented. The following comparison of the flotation and table concentration methods is based on estimates of Walter Broadbridge, chief engineer of the Minerals Separation company.

Taking a mill treating 1000 tons of 2% copper ore per day, from which, under the best table and vanner methods, a possible 70% recovery may be assumed, with copper at 12c., the yearly yield will be $1,226,400. Against this an 85% recovery is obtainable by the Minerals Separation process. Assuming on a conservative basis that fully 50% of the crushed ore will need recrushing at a cost of 20c. per ton, and allowing also for the additional cost of smelting, the net results will work out as follows: With copper at 12c., $1,459,109, showing a balance of $232,709 in favor of the flotation method.

This is equivalent to over 2s. 6d. per ton of ore net, or more than sufficient to amortize the whole of the cost of Minerals Separation plant plus that of the extra fine-crushing plant, in less than three months' operation, says John Ballot, managing director of the Minerals Separation company. In other words, the copper produced from a 2% ore will cost at least 1c. less per pound to produce, which again is equivalent to over £4 per ton of total metal won.

Flotation Saves Greatly in First Cost

The comparison is then applied to a mill handling 2,000,000 tons per annum, of which there are several in the United States and elsewhere. With wet or table-and-vanner concentration, a plant of this capacity would require 850 concentrating tables and vanners, occupying a floor space of over 200,000 sq.ft., consuming not less than 870 hp., with a capital outlay of at least £125,000. A Minerals Separation plant to treat this quantity, according to Mr. Ballot, would require only nine units, occupying a floor space of not more than 15,000 sq.ft., would cost less than £20,000, and would require only 400 to 450 hp. A charge of £30,000 should be added to the above figure, raising the cost to £50,000, if it is necessary to fine-grind the ore.

In capital outlay alone, the table and vanner plant would, therefore, cost 500% more than a Minerals Separation plant of equal capacity, or over 150% more than a flotation plant plus the additional recrushing plant recommended. The production of copper, assuming 85% recovery (in many cases recoveries may be as high as 90%), would be increased from 54,000,000 lb. to over 62,000,000 lb. The net saving would amount to £239,-105, taking copper at 12c. per pound.

Mr. Ballot states that his company is prepared, subject to suitable arrangements and facilities, to make good this statement by undertaking to erect a 1000-ton plant for the price named at the given mine with which the estimates have been compared, and to run it against an installation of tables and vanners of like capacity.

THE COST OF DOING THINGS

Dredging Costs

In a paper "Present-Day Problems in California Gold Dredging," by Charles Janin, published in *Trans.*, A. I. M. E., Vol. XLII, a table of working costs is given for gold dredges, from which the following notes were taken: A 3-cu.ft. bucket dredge, working under favorable conditions, moved 458,882 cu.yd. of gravel in 7216 hr. actual working time. The average depth of gravel was 26.9 ft., and the total cost was 7c. per cu.yd., consisting of 2.03c. for labor and supplies; 0.69c. for electric power; 3.28c. for general repairs; 0.63c. for general expenses, and 0.37c. for taxes and insurance. The cost of the same size dredge working under unfavorable conditions was given at 9.23c. per cu.yd. This cost was afterward lowered by installing a 7-cu.ft. bucket dredge.

A 4-cu.ft. bucket dredge, operating 7057 hr., handled 484,387 cu.yd. of gravel from an average depth of 20.6 ft. at a cost of 6.52c. per yd., made up as follows: Labor and material, 1.83c.; electric power, 0.89c.; water, 0.31c.; repairs, 2.58c.; general expenses, 0.65c., and taxes and insurance, 0.26c. per cu.yd. A 7.5-cu.ft. dredge, working in a medium compact bench of gravel of an average depth of 27.9 ft., handled 3,458,229 cu.yd. in 13,464 actual working hours, at a cost of 4.42c., including depreciation on equipment. For the year ended Feb 28, 1911, the Yuba Construction Co. handled 13,970,728 cu.yd. of gravel at a total cost of 5.67c. per cu.yd., and the Oroville Dredging Co. is reported to have handled 5,661,612 cu.yd. for 5.05c. per cu.yd. It is also said that a dredge of a daily capacity of 1000 to 1300 cu.yd., operating at Nome, Alaska, costs from $110 to $125 per day to operate. In May, 1911, the Colorado Gold Dredging Co., operating in Swan Gulch, was reported to be handling from 3000 to 6000 cu.yd. per day at a cost of 5c. per cubic yard.

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Oriental Consolidated

The Oriental Consolidated Mining Co., Chosen, Asia, according to its annual report for the year ended June 30, 1912, treated 323,703 tons of ore averaging $5.86 per ton. This tonnage was made up of 321,343 tons of $5.87 ore from the company's mines, and 2360 tons of $4.33 ore from tributers. The total cost of production was $2.83, made up as follows: Mining, $1.62; transportation, 1c.; milling, 50c.; concentrate treatment, 20c.; general expenses, 36c.; development at outside mines, 5c., and construction expense, 9c. per ton. These costs include 26,359 ft. of development work in the regular mines of the company and 4242 ft. on outside properties, or a total of 30,601 ft. on the concession. The assay office made 31,361 assays at a cost of $5425, an average cost of about 17.2c. per assay and an equivalent of one assay for every 10.3 tons of ore treated.

A statement of cyanide expense shows that 49,715 tons were treated at a cost of $1.70 per ton cyanided, made up of: Supplies, $1.15; assaying, 3c.; concentrate transportation, 2c.; outside shops, etc., 3c.; electric power, 2c.; salaries and board, 22c.; and payroll, 23c. per ton. Some of the detail costs of supplies were as follows: Cyanide, 53c. per ton; zinc and zinc dust, 6c.; borax, 2c.; lime, 7c.; crucibles, 2c.; and cordwood, 25c. per ton treated. The unit costs of some of these articles were: Cyanide, 2.72 lb. per ton of ore cyanided; zinc and zinc dust, 0.71 lb. per ton; borax, 0.42 lb.; and lime, 10.2 lb. per ton treated. Milling costs were made up of: Supplies, 28c.; assaying, 1c.; outside shops, etc., 2c.; electric power, 5c.; salaries and board, 8c.; and payroll, 6c.; total, 50c. per ton. Mining expense was made up of: Supplies, 89.9c.; assaying, 0.3c.; outside shops, stables, etc., 1.9c.; salaries and board, 11.2c.; and payroll, 58.5c., a total of $1.618 per ton.

The detailed statement of mining expense shows cordwood to have cost 27c. per ton mined; timber, 22.5c.; lumber, 10c.; dynamite, 8c.; detonators, 1c.; candles, 7c.; fuse, 2.5c.; oils and lubricants, 1.3c.; drill steel, 1.29c.; and ore cars, 0.57c. per ton of ore mined. The dynamite consumption was equal to 0.415 lb. per ton of ore. There were 163,740 lb. of candles consumed, which is equal to 1 lb. of candles for every 1.97 tons of ore mined. There were 1,690,750 ft. of fuse and 750,300 detonators used, which is equal to one detonator for every 0.177 lb. of dynamite used and 2.25 ft. of fuse for every detonator. Drill-steel consumption was about 1 lb. for every 7.3 tons of ore.

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Rand Mining and Milling Costs

By E. M. Weston*

The costs of mining and milling on the Rand, as given below, are taken from the reports published by the houses controlling the various groups of mines. The first to be considered is one of the mines on the East Rand with a reef lying at an angle of about 15°. The reef is underlain by a body of soft shale, having a good breaking flow on this contact. The overlying quartzites are hard compared with most of the Rand, and the reef is not much faulted. The mine is milling with 180 stamps and seven tube mills at its rated capacity of 52,580 tons per month. The total costs are $4.21 per ton milled. No easily broken ore is being drawn from reclamation work, so that costs are not benefiting by former mining operations.

To keep the mill supplied, large machines are mostly employed, but about 28% of the ore is broken by hand labor. To supply the monthly tonnage required for the mill, an area of 3131 square fathoms is exhausted, or 112,716 sq.ft., or nearly two Transvaal claims.

Closer Sorting Should Be Done

There are also about 3600 tons of rock milled per month from development work. Nearly 13% of waste is sorted out. At the neighboring New Kleinfontein mine,

*Mining engineer, Union Club of South Africa, Johannesburg, Transvaal.

working similar ore, owing to a complete system of double breaking and sorting, it is found possible to reject economically from 20 to 25% of the ore mined, and it may be said of nearly all the mines of the Rand that it would be possible, with more efficient plants, to reject much more waste than is done at present.

To break a ton of rock in this mine, by native drillers, costs $1.03 per ton, and owing to the conditions stated below, this is much cheaper than the average. Each native breaks 1.2 tons per shift. Of this $1.03, the white workman takes $0.16, the native nearly three times as much, in wages, while his food, etc. (native labor sundries), costs between 22 and 24c. per ton.

Owing to the easy nature of the ground, explosives cost a fraction over 14c. per ton. The average footage drilled per boy per shift was 40 in., and the stoping width 54 in. The pay-reef widths are, it will be noticed, not given, so that it is impossible to judge as to the amount of waste broken. Cost per fathom is $19.94, and natives earned 57c. per shift.

Machine Stoping

Seventy-two per cent. of the ore broken is by machines and few small machines are used. Large machines were worked with a stoping width of 70 in., and broke 10 tons, or 0.65 fathom per shift at a cost of 97c. per ton broken, or $14.96 per fathom; of this sum of 97c., white drillmen earned 23c. per ton, and natives only half that amount, with about 30c. of it for their food, etc. Explosives cost 21c. per ton, as against 14c. for hand stoping. This illustrates the law that the amount of explosives required increases as the square of the burden. Machine holes, causing a much larger burden than hand holes, and being also bored four or five at a time, are more inefficient. Little stoping in this mine was done with small machines, and the costs are not of interest. In this mine considerable packing of waste rock and timbering is done in the stopes, and the cost per ton was $1.09, of which about 30% was for timber and 40% for white wages. No sand filling was carried out.

Shoveling and tramming were carried out with an average distance trammed of 1260 ft., at a cost of 77c. per ton. Mules are, I believe, used in certain drives. The tons trammed and shoveled per native employed was only 1.8 tons per shift, white wages cost 9c. per ton, native wages 24c. per ton, with 16c. per foot, etc. (compound and recruiting fees). Trucks, rails and fittings cost 8c. per ton. Tramming costs, along levels, are unfortunately always shown mixed with shoveling and conveying costs in stopes, so the cost per ton-mile of the various systems now emplowed, electrical, tail-rope haulage mules and natives, are still unobtainable.

Winding cost 21c., of which power cost 14c. and white wages about 2c. per ton.

Pumping 7,000,000 gal., about 1000 ft. vertical, cost 71c. per 1000 gal., of which nearly one-half was for power and one-fifth for white wages.

Other mine costs amounted to 27c. per ton, including £800 (6.8c. per ton) for managers, mine captains, shift-bosses, mill, cyanide and surface-bosses salaries. Power for ventilation cost £950, or 8.1c. per ton milled. Total mining cost amounted to $2.24 per ton. Ore sorting and crushing cost 9c. per ton, surface transport only 1.6c., the mill being near the chief winding shaft. Stamp milling (180 stamps and seven tubes), cost 22c. per ton milled, white wages came to 2.8c., power to 12.1c. per ton, and shoes and dies 2.2c. per ton. Tube milling cost 15.7c., of which power cost 8.1c. and liners 1.2c. per ton, and white wages 1.2c. per ton milled. Amalgamation cost 5c. per ton; of this, white wages amounted to 3c. and mercury to only £18 for the month for milling 25,580 tons.

Cyanide sands cost 39c. per ton treated, or 23.8c. per ton milled; of this, white wages claimed one-eighth and power one-sixth. Cyanide cost 5.4c. per ton milled, lime £50, zinc £60 and chemicals £20. The contractor for removing tailings received about 4c. per ton milled. Assaying and smelting cost £131. Cyaniding slimes cost 39.9c. per ton treated, or 17.1c. per ton milled, of which white wages claimed one-sixth, cyanide one-sixth and power one-fifth; lime £74, zinc £60, chemicals £29 and assaying and smelting £66. Total reduction costs were 94.1c. A glance at these figures shows how the consumption of cyanide, mercury, lime and zinc has been economized and how little scope there is, with a cost such as this and a high extraction, for new processes.

Mine general expenses amount to 24.3c. per ton; £393 is paid per month in insurance fees for fire and life. One hundred and seventy-six feet of hand development (winze sinking) cost $7.24 per foot. Driving 906 ft. with large machine costs $10.076 per ft.; 70 large machines were running in the stopes, and 25 in development work.

The duty per stamp was 10 tons. The total theoretical extraction of sand was 90%, and of slime, 94.8%. The total theoretical extraction was 97.5%, and the actual, 93%. This mine employs 546 skilled whites, 270 on the surface and 276 below. The average monthly earnings of miners was £29.6, and of surface workers £28.5; 3818 natives were employed and earned 44.5c. per shift. Food cost, per shift worked, 12.1c., and recruiting and compound expenses, cost 16.2c. per shift worked, so that native labor cost 72.8c. per shift; 95% of the natives worked, 2% being absent through sickness, and 2% from accidents.

Deep-level Costs

Turning now to a recently started deep-level mine on the Central Rand, milling 38,000 tons per month (with 194 stamps and nine tube mills, capable of treating 65,000 tons), we find, that of these 38,000 tons, 27,700 were mined, the rest being rock from former development. Total costs were $5.35 per ton milled.

Here 2800 tons were broken by hammer boys, with an average of 33 in. per shift. Explosives cost 30.3c. per ton. The stoping width was 44 in., only 0.5 tons per boy per shift were broken, at a cost of $2.733 per ton. Large machines broke 7850 tons, with a stoping width of 55 in., at a cost of $1.87 per ton. Each machine broke 7.2 tons per shift. Explosives cost 36.5c. per ton. Small machines broke 12,600 tons on a 47-in. stoping width, at a cost of $2.43 per ton, treating 3.7 tons per shift. Explosives cost 40.5c. per ton. Reduction costs were $1.154 per ton; development with large machines, 900 ft., cost $13.138 per ft. The theoretical extraction was 94%, and the actual apparently over 100%. Work on this mine was suffering from unfavorable conditions and mistakes in development so that these results are under the average.

(To be concluded)

Sinking a Circular Shaft—I

By E. Mackay Heriot*

SYNOPSIS—The circular shaft possesses many advantages over the rectangular section, except in the case of temporary shafts through durable rock in places where timber is cheap. The cost and speed of sinking, the surface plant, and the methods of placing masonry and concrete linings are discussed.

The circular shaft adapts itself to any conditions, the practice being now so perfected that "failure" and "experiment" can no longer be spoken of it. In these articles I shall describe shaft sinking in hard rock needing practically no fortification; shaft sinking in bad ground; and finally, sinking with a view to making a shaft watertight.

Improved Methods of Sinking

Not long ago it would have been impossible to sink a shaft through any depth of quicksand. Today the Pötsch process of freezing the ground is known to all. Again, the sinking of a shaft through a river of water, not long ago, was impossible. The now celebrated Yessenitz shaft during 10 years attempted to sink from 130 to 175 m. depth, without success; two pumps with a combined capacity of 880 gal. per min. were employed. This shaft has since been sunk by the Kind-Chaudron method. I shall later show how shafts have been sunk through over 8000 gal. of water per minute. I do not propose here to go at any length into the difficult cases of sinking, but rather to discuss circular shafts from a general point of view.

There is no doubt that the circular shaft is becoming more common practice day by day, on account of its simplicity and speed in sinking, but more especially on account of its permanency. Nearly all large coal-mine operators in England and the Continent favor the circular shaft. The new potash-mining industry of Germany, which we have to thank for many perfections in shaft sinking, has not a single rectangular shaft.

As to the advantages of a circular shaft in comparison with a rectangular, I refer to my article[1] in the Engineering and Mining Journal dealing solely with this subject. The chief arguments in favor of the rectangular form are that it is more suitable for timbering, and that it involves less "waste space."

In the first place, a timbered shaft is never a permanent work, and retimbering a shaft is always a costly job. In places where timber is plentiful, but masonry and iron are hard to obtain, the rectangular shape is generally the more practical, but under no other conditions.

Secondly, all shafts have "waste space," but in those of round section it is more discernible than in those of rectangular form. This is more apparent in the rectangular because the square sides around the cage look tightly fitting, assuming that a round shape has more waste space. Allowance must be made for the fact that the lining of a circular shaft need not be so thick, because the pressure around the circumference is practically uniform. This means that the excavation for bricking a rectangular shaft must be larger than that for a circular shaft of equal perimeter. Another fact to be considered is that the relation of circumference—the exposed part—to area is more favorable in the round shaft, especially in those of large size. For instance, a modern seven-compartment shaft of the Rand, 14.6 m. long by 2.44 m. wide, requires an excavated area of 35.04 sq.m. A round shaft of 6.75 m. diameter has somewhat more area, but its circumference is only 21.20 m., whereas the rectangular shaft has a total exposed perimeter of 34.08 meters.

From the Transval Chamber of Mines statistics for January, 1910, I see that only three companies treated over 90,000 tons of ore each, and only six companies over 60,000 tons. We may therefore take this latter figure as a high monthly output for a metal mine. The circular shafts used in modern Continental practice are capable of an output up to 4500 tons in 20 hr., which would give an extraction during 26 days of 117,000 tons. This is for an average depth of 600 m., for a depth of 1200 m., say 70,000 tons. The coal mine Zache Prosper can easily hoist 3600 tons in two eight-hour shifts from 400 and 800 meters.

Cost and Speed of Sinking

Concerning the costs of sinking, comparisons are not easy to make because these differ even at the same locality. The total cost of a certain five-compartment shaft on the Rand, through hard quartzites, is stated at £73 6s., per m., and of another shaft through hard diabase at £92 3s. per m. There seems to have been little water to contend with, and the shafts were lined with timber. These shafts had 28.4 sq.m. area; this would be equal to a circular shaft of 6 m. diameter.

In Westphalia the total costs come to £60 per m. in *Mergel* and to £50 in the coal measures. In Westphalia the costs are taken as follows: Shaft with diameter of 3 to 6 m. in *Mergel,* £35 to £60 per m., and in coal measures £30 to £50. With an additional diameter of 0.5 m., the costs in *Mergel* are, as a rule, £5 more, and in *Stein-Kohlen gebirge,* £4 more per meter.

Concerning the speed of shaft sinking: On the Rand this has been from 12 to 41 m. per month, giving an average of 24.4 m. In round shafts noteworthy speeds have been recorded where it has been possible to sink and wall simultaneously, as, for example, at Gneisenau No. 2 shaft, where as much as 32 m. in a month were sunk in coal measures, and at Preussen II/II where the rate was 40 m. in *Mergel,* including lining. At Werne Nos. 1 and 11 shafts at 388 and 346 m. depth, the average was as high as 49 m. per month, the record being 60 m. On the other hand, we observe General Blumenthal IV, with 7.3 m. per month, where the maximum water inrush was 14 cu.m. per min., and the average 6 cu.m. per minute.

I will now proceed to describe the various ways to attack a shaft-sinking enterprise from a practical standpoint. Let us bear in mind that "the vertical shafts for any deep mining propositions should be sunk and equipped in such a manner that their efficiency even in their later years, when the mine is approaching exhaustion, shall be equal to what it was originally. Careful specifications should be drawn up and should be rigidly followed." This is sound advice, both to mining men and to the shareholder.

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[1] "The Shape of a Shaft," by E. Mackay Heriot, Eng. and Min. Journ., Dec. 30, 1911, p. 1283.

Surface Arrangements

These depend to a considerable extent on the size of the shaft to be sunk. We shall consider here a modern shaft for a large output. On the Continent it is common practice to sink two shafts near one another, so called *Zwillingschächte,* at the same time. This, of course, is more economical than sinking them at different periods. The two hoisting engines can be placed under one roof and the steam can be generated from one battery of boilers. The superintendence is combined and the rooms for the men can be used in common for both shafts.

For sinking large and deep shafts, direct-acting engines having two high-pressure cylinders and rated at 50 to 200 hp. are employed, but for shallow shafts geared engines of from 50 to 80 hp. will suffice. The larger engines have both steam and foot brakes and cost about £1000. All engines for shaft work should have steam brakes.

The speed of sinking depends to a great extent on the organization of the surface plant. Everything must be arranged so that the mucking can be carried out with the utmost speed. On this account I am giving designs of such surface apparatus as is used in modern Continental practice.

The bucket should be joined to the rope with a hook of large dimensions, so that when the bucket reaches the shaft bottom a man can hold back the tongue of the spring hook and so unlodge the bucket before the rope becomes slack. When once the rope is slack, this operation is difficult. An approved form is shown in Fig. 1. Three or four buckets are in continual use.

The buckets are made of steel plate and are of 300 to 600 l. capacity; for a shaft of 5.5 m. finished diameter, one would use a bucket of 0.88 m. diameter and 1.0 m. high, constructed as shown in Fig. 2.

For sinking, the ropes should be flat, because they do not twist so much as the round ones, and being used on *Bobinen* the weight of rope is to some extent equalized. I, personally, have found these practical. The ropes were galvanized and needed no greasing. Thus the daily inspection was very easy.

Headgear

There are many classes of headgear. I propose to show part of one which I consider practical for a large shaft. It will be noticed that the two main hoisting sheaves and the four for the guide ropes are placed on the same platform, Fig. 3. The sheaves for pump and hanging platform can be placed at or near the landing-stage platform.

As a rule the trucks are pushed on to the landing stage over the shaft. I myself consider this a very speedy way of handling the material, but as the buckets are sometimes carelessly tipped, allowing rocks to fall on the shaft doors, mine managers now prefer to deposit the muck in bins over the shaft, as shown in Fig. 4.

The bucket guider, so called "monkey," should be made of iron, should not be too short and should have bearings of bronze where the guide ropes pass through. A suitable form is shown in Fig. 5. To avoid shocks when the monkey is being lowered to or taken off the bearings, rubber blocks can be fitted on the hoisting rope above the bucket. These blocks rest on an iron bracket clamped to the rope.

As already indicated the bucket guides are ropes. The permanent timber or iron guides are not put in until the shaft sinking is completed. The guide ropes are placed on four iron hand-winches, from which they pass over pulleys on the top of the headframe and down through the shaft. Here they are fastened to four timbers, as shown in Fig. 6. As the shaft gets deeper these timbers are moved downward with the ropes. Special holes are made for them in the shaft masonry wherever it is considered desirable to place them. To determine the exact position, an eastern and a center plumb line are hung. The two outside holes should be 350 mm. and the center one 150 mm. deep. The height is seven bricks for the former and five for the latter. For covering the holes a flat piece of iron can be used. In the provisional lining, these timbers are lashed to the rings, using the plumb as above for determining the location.

The placing of steam piping in the shaft may cause difficulties. As the pumps used in sinking are of the hanging type and must allow easy moving up and down the shaft in connection with cable and piping, the method shown in Fig. 7 is found practical. The clamps hold steam, exhaust-steam and delivery pipes together, and are placed about every 10 m. apart. They hold the pipes fast but allow the cable to pass freely. In order that the weight of the pipes may not come upon the pump, wooden clamps are put on them at some suitable place, as at the bucket-guide bearers. The pump cable is fastened at the surface to a hand or steam winch, as the case may require. At different positions along the steam piping, telescopic joints should be placed to allow for expansion. Rubber suction pipes for the pump I found impracticable because if they are to be handled properly, the whole pumping apparatus has to be lowered after every 0.5m. advance; more usually, however, it is lowered far enough to allow the suction pipe to lie horizontally. This often has the effect of preventing the shutters of the wind-ball valve from closing, and allows the water to drain out. No doubt this is to blame for many stoppages. The best method is to use a telescopic tube, which can be drawn out while pumping. This is done with the aid of a small differential pulley. When blasting, it should be so arranged that the suction tube can be pushed back 1.5 m. and the pump hoisted another 1.5 m. or more, as necessary, these movements being done simultaneously.

Hanging Platform

It is important that the hanging platform on which masonry and other work is done be strongly made and well secured. At a shaft at which I was employed, a bucket full of sand and cement weighing over one ton struck such a hanging platform with a speed of over 8 m. per sec. A hole was made in the planks and two 8x8-in. timbers were broken, but otherwise no damage was done. The platform to which this happened is shown in Fig. 8. At the time 20 men were at work, but no one was hurt.

It will be noticed that the suspended platform is made fast to the rope with four ropes and four chains. It is composed of two iron girders upon which five wooden bearers are set. The main girders are joined together by two iron channels and these in turn by two smaller channels. Over the wooden bearings a double row of 40-mm. planks are laid. The platform should be so constructed that it can be put together at the pit bottom in a few hours. The main cable which holds the platform is actuated by a specially constructed hoist.

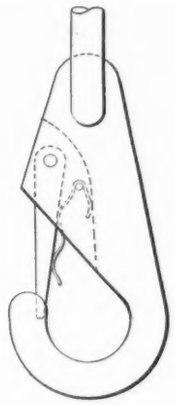

FIG. 1-HOOK FOR BUCKET

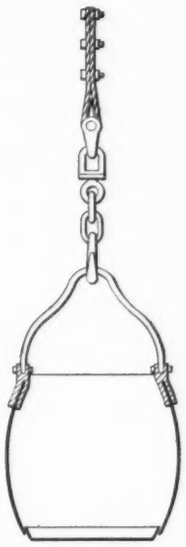

FIG. 2-SINKING BUCKET

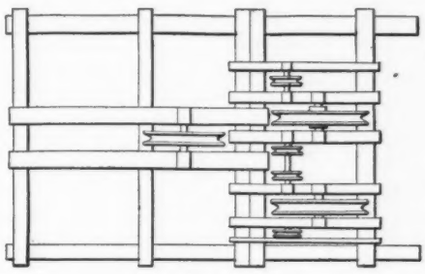

FIG. 3
PULLEY ARRANGEMENT AT TOP OF HEAD FRAME

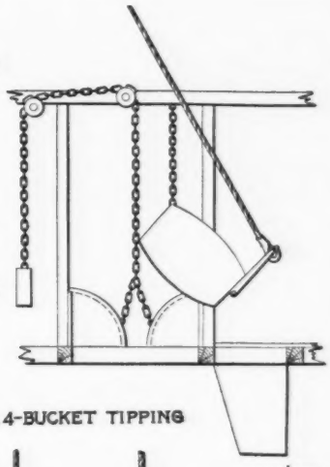

FIG. 4-BUCKET TIPPING

FIG. 6-UNDERGROUND FASTENING OF THE GUIDE ROPES

FIG. 7-METHOD OF SECURING PIPES IN SHAFT

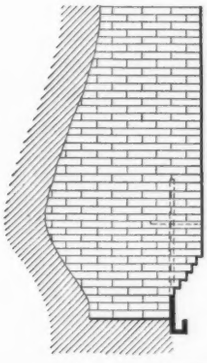

FIG. 11-SUPPORTING WALL

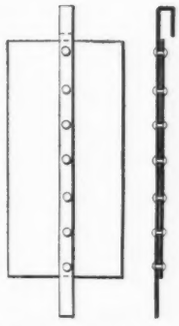

FIG. 14-TEMPORARY LINING WITH SHEET IRON

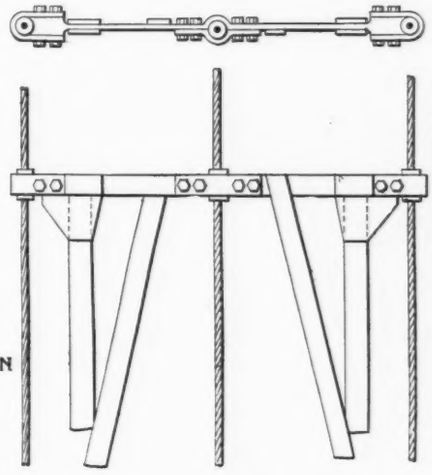

FIG. 5-THE BUCKET GUIDE OR MONKEY

FIG. 12-HITCHES FOR PERMANENT LADDERWAY

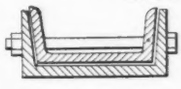

FIG. 12 A-METHOD OF LASHING THE RINGS TOGETHER

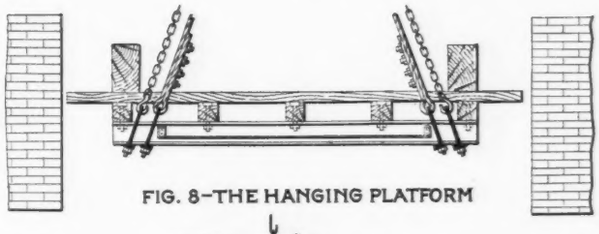

FIG. 8-THE HANGING PLATFORM

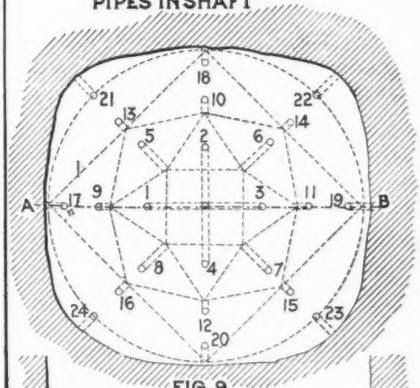

FIG. 9
SECTION A-B

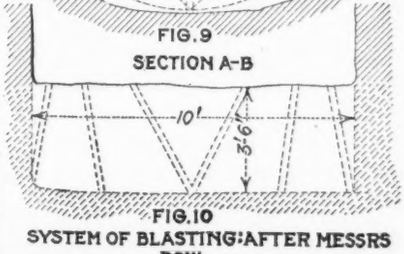

FIG. 10
SYSTEM OF BLASTING: AFTER MESSRS DOW

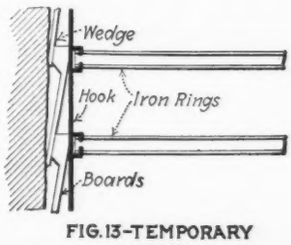

FIG. 13-TEMPORARY LINING

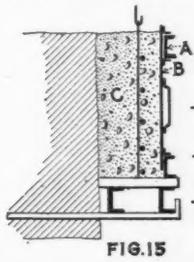

FIG. 15

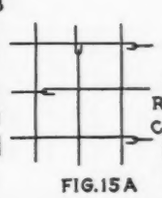

FIG. 15 A

METHOD OF REINFORCED CONCRETE FOR LINING: AFTER HEISE-HERBST

ENG. & MIN. JOURNAL

DETAILS OF CIRCULAR-SHAFT SINKING

The surface equipment is reckoned in Germany as costing as follows:

(1) Headframe	£400
(2) Hoisting engine (second-hand) with house and foundations	900
(3) Steam winch (second-hand) with house and foundations	350
(4) Suspended platform	100
(5) Buckets, pulleys, ropes, etc.	350
(6) Pump (not excess)	500
(7) Boilers, plant and house	1250
(8) Offices and shops	750
(9) Various	400
Total	£5000

In case of simultaneous sinking and walling, these costs are to be taken about one-fourth higher.

Methods of Excavation

The actual drilling is carried out with machine drills or by hand. The latter system is often followed. Everyone agrees that the main point as regards speed is to do the mucking as quickly as possible. If the ground is not too hard, long drills, 4 m. long and sharpened at both ends, are used. These give good results.

Great care should be used in placing the holes and making up the cartridges. Each sump shooting should attain the greatest possible depth because each operation is very costly in time. The pumps have to be lifted and afterward lowered and, again, time is lost in waiting for the smoke to rise. Small ventilators, in conjunction with 0.5-m. corrugated galvanized-iron tubes, are useful for speeding this latter operation, as well as for the general ventilation of the shaft.

As regards the depth of the holes, this varies according to the rock to be blasted from 1 to even 3 m. Perhaps 1.5 m. may be nearer the rule. If the rock has a steep dip, the sump is placed near the side to which the dip inclines, because the blasting action is there most favorable; also when much water is encountered it is sometimes advisable to shoot the sump near one side of the shaft, so as to keep as big a space as possible free from water.

Opinion is divided as to whether one should fire all the shots at once, that is to say, both sump and side holes, together. Personally, I prefer to shoot first the sump and afterward the side holes; in fact, the side holes can be drilled while the mucking of the sump is going on.

Then it is a question whether the shots should be fired by hand or by electricity. The latter is safer for the men, because they do not ignite the fuses underground; but on the other hand, it is difficult to tell if any shots have misfired. In firing by hand, the "lifters" are given the shortest length of fuse, the remaining sump holes somewhat longer and the side holes the longest, but each hole has a different length of fuse, thus allowing them to go off separately. It does happen, when the ground is soft, that some holes go off together, but as a rule, this is not the case.

In order to control the blasting properly, the advance obtained by each round should be booked. It is not the highest heap of broken débris that gives the best sump. This can be ascertained only by measurement. If, for instance, holes drilled to 2 m. depth do not give about 2 m. of shaft, other methods should be tried. I found in one such case that the lifters had not been given sufficient incline.

According to Messrs. Daw, the center cut is the most suitable for sinking a circular shaft. If it is required to sink a circular shaft of 10 ft. diameter, and the coefficient of the rock is 0.21 for gelatin dynamite (corresponding to a line of resistance of 1 ft. 10 in. for each ⅛ in. diameter of hole), 24 holes will be necessary to sink the shaft 3½ ft., if placed as indicated in Figs. 9 and 10. The charges should be fired in the following order:[2]

Volley	No	
1	1, 2, 3, 4	simultaneously
2	5, 6, 7, 8	simultaneously or consecutively
3	9, 10, 11, 12	simultaneously or consecutively
4	13, 14, 15, 16	simultaneously or consecutively
5	17, 18, 19, 20	simultaneously or consecutively
6	21, 22, 23, 24	simultaneously or consecutively

The total weight of explosive required for sinking the shaft a depth of 3½ ft. is 24x¾ lb. = 18 lb. If the ground is not extra hard, one may say that hand drilling is more favorable than machine work; otherwise machine hammer drills are not to be recommended.

Masonry Lining

For masonry, bricks bound with cement mortar are used. The usual dimensions of the bricks are 250x120x 65 mm. For ordinary rock, the mortar used in Westphalia contains two parts lime, two to seven parts trass concrete, one or less part cement, and three to seven parts sand. Where there is water pressure requiring watertight masonry, only cement and sand are used in the proportions of 1:2 or 3. Lime and sand alone are used only where the rock is quite dry. In some cases cement is mixed with the lime and sand, and at other times cement and sand alone are used.

Whatever lining is to be used in a shaft, it is always convenient to give the first few meters near the surface a good foundation of masonry. At a convenient depth the rock is hewn out to suit the supporting wall, as shown in Fig. 11. The masonry for this should be bedded in cement. The thickness of this masonry depends on the water pressure and the rock. It may be 1½ or 2 bricks, or as much as four or more bricks. The supporting wall should always be about four bricks thick. The shaft is then sunk to a certain depth, when another supporting wall is built in and the lining erected upon it to meet the preceding one.

Hitches for the permanent guide bearers can be spaced 1.5 m. apart. For locating these, a special plumb line is hung, which, together with the center plumb, should be constantly used. Plumbing from hole to hole is not advisable because any mistake is carried on. The best plan is to stretch a cord within 1 cm. of the two plumb lines, and with a right-angle measure the necessary distances and make marks where these touch the inner circumference of the brick wall. A wooden pattern can be placed at the mark, and the outline of the hole drawn on the wall. It is always best to locate the deeper hitches where the wall is strongest. For timber guide bearers the holes are 260 mm. broad, 250 to 150 mm. deep and four to five bricks high. Then the holes for the temporary and permanent ladderway are to be made. For the former, the hitches of the main bearers are used, with a slight alteration in that three rows above these a recess is let in the wall for the planks of the sollar. For the permanent ladderway bearers, special hitches have to be made, as also recesses for the planks. These are shown in Fig. 12.

The temporary shaft lining for fortifying the side during sinking consists of iron rings which, according to the size of shaft, are divided up into four or six segments. The segments are lashed together as shown in Fig. 12a.

[2]"The Blasting of Rock," by A. W. and L. W. Daw.

The lagging behind the rings is either of pine or oak boards, or of sheet iron. The former is shown in Fig. 13, and the latter in Fig. 14. To secure the rings, they are either hooked together by iron uprights or bolted. For temporary lining the former method is easier. It will be seen in Fig. 13. One of these hooks is also seen bricked into the supporting wall in Fig. 11.

When beginning to sink a shaft, provision should be made for making fast the first ring. This can be done provisionally by securing it with hooks to large timbers placed horizontally on the surface. Directly beneath the supporting wall, the first two rings are somewhat under normal size. This is done to allow the shaft to recover gradually its proper dimensions.

Concrete Lining

Both concrete and masonry are not suitable for very heavy pressure because of their small bending resistance. In case of any rupture it is more difficult to make a fresh joint with concrete than with masonry. Reinforced concrete permits less thickness than masonry, and will withstand considerably higher pressure. However, the strength of reinforced concrete depends not only upon the amount of cement, but also on the quantity and strength of steel used, and on its manipulation.

Of late, several shafts have been lined with concrete, but further experience is yet to be gained in this art. For a single compartment, a reinforced-concrete lining is suitable; for larger shafts, however, some difficulties are encountered. Weep holes are not desirable; the concrete should exclude the water entirely, and must, therefore, be designed to withstand hydrostatic pressure. The concrete and the country rock, if the lining is well carried out, will be one mass. For ordinary shafts the following mixture is recommended: Cement, 2; lime, 1; broken stone, 17; sand, 14 parts, but for heavier pressure or watery formations more cement must be added.

A system for employing reinforced concrete in shaft linings is shown in Fig. 15. The lining was placed in sections of 28 to 25 m. each. *A* is a U-shaped iron ring made up of four segments. *B* represents the iron sheets forming the mold. *C* is the concrete with iron rods. The iron rods were placed as shown in Fig. 15a. The concrete is filled in layers of 15 to 20 cm., and is well stamped. This work needs special care. In a month the iron forms can be taken away. According to Messrs. Heise-Herbst,[3] 3 m. could be lined per day at a cost of about £16 16s. per m. of shaft. The cost of 3½- to 4-brick walling would come to nearly £25.

In the shaft in the Swanzy district of Michigan I notice the lining of reinforced concrete in a circular-shaped shaft of 7.3 m. outside diameter was 61 cm. to 5 m. depth, from 5 to 15 m. it was increased to 76 cm.; from 15 to 25 m. to 91 cm., and finally from 25 to 34 m. to 106 cm. The concrete was reinforced by using 1-in. square steel bars, spaced 6 to 8 in. vertically and about 18 in. horizontally.

It is interesting to note that at Messina not a building of reinforced concrete was damaged by the earthquake, showing that it withstood the shock and vibration. There is no doubt that reinforced concrete has an important future in shaft lining.

(To be concluded)

[3]"Bergbaukunde," by Messrs. Heise-Herbst.

Some New Construction at Copper Smelteries

A brief review summarizing some of the new construction at copper-smelting plants is presented herewith. These data will be of interest, notwithstanding that they do not represent all the new work undertaken in 1912. The last year was an active one in respect to construction of new smelting plants, particularly in the Southwest. At many other works, improvements were carried out with a view to increasing capacity and decreasing operating expense; noteworthy in the latter connection was the increasing vogue of the upright converter of the Great Falls type, lined with basic brick. Not only were many of these installed during 1912 in U. S. plants but American manufacturers shipped a number of shells abroad. The leading features of several of the new plants are given below:

New Calumet & Arizona Smeltery

Construction was started on Jan. 1, 1912, for a new smelting plant for the Calumet & Arizona Mining Co., at Douglas, Ariz. The plant is expected to commence operations in September, and will treat ore from the mines at Bisbee and Courtland. The plant will comprise four reverberatory furnaces, 12 Herreshoff calciners, two blast furnaces and six vertical converters. The reverberatory furnaces will be 19x100 ft., and the estimated tonnage is 300 tons each. The Herreshoff roasters will be 21 ft. 6 in. in diameter and have air-cooled arms. The dimensions of the blast furnace will be 48 in. by 40 ft. at the tuyeres, and the estimated daily capacity of the furnaces is 800 tons each. The company is installing six converters of the Great Falls type, and anticipates a production from a 33% matte of about 35 tons of copper per day from each converter.

Arizona Copper Co.

The Arizona Copper Co., at Clifton, Ariz., is building a new smelting plant at an approximate expense of $2,500,000, and it is expected that this works will begin operation during the coming summer, the date of starting being dependent now upon the delivery of certain material. The plans provide for three reverberatory furnaces 100 ft. long by 22 ft. wide. As these furnaces will be about 3 ft. wider than the usual 100-ft. reverberatory, it is anticipated by the designers that a tonnage approximately 20% greater will be smelted. Eight Herreshoff roasters, 21 ft. 8 in. in diameter, are being constructed. No blast furnaces are being installed at present, but space was provided so that if in the future they are needed, the furnaces can be added without interfering with the operations of the rest of the plant. Three 12-ft. vertical converters of the Great Falls pattern are to be installed, and with the grade of matte which is expected to be produced in the reverberatories, it is anticipated that a maximum tonnage of 50 tons of copper per day will be obtainable when desired. About 10% of the material to be treated in the new smelting plant will consist of direct smelting ores, the remainder of the charge will be concentrates produced at the company's mills.

At Cananea, the only important change in 1912 at the plant of the Cananea Consolidated Copper Co. was the addition of two Great Falls type upright converters; these have 24 tuyeres and are 12 ft. 3 in. outside diameter. Other new construction underway was the replacing of

four barrel-type converters with four more upright converters, having 30 tuyeres each. All converters are to be basic lined. In 1913, the two straight-line casting machines will be placed in operation.

The Hayden Smeltery

The new plant of the American Smelting & Refining Co., at Hayden, Ariz., was placed in operation in April, 1912. This is a reverberatory smelting plant, treating the product of the Ray Consolidated Copper Co. About 600 tons are handled daily, the charge consisting of approximately 20% of crude ore and 80% of calcined concentrate. There are two reverberatories, 112 ft. long by 19 ft. wide, which produce a matte containing about 40% copper. This is treated in two Peirce-Smith converters, 25 ft. long by 10 ft. diameter. About 60 tons of copper are produced per day.

Mason Valley Mines Co.

The new smeltery of this company was blown in on Jan. 6, 1912, and contains two blast furnaces originally 25 ft. in length by 45 in. at the tuyeres. During 1912 one of these furnaces was lengthened to 30 ft. and the other furnace was increased to 35 ft. in length. In the 30-ft. furnace a capacity of 950 tons of charge, exclusive of coke, has been attained, and it is expected that 1100 tons of charge will be handled by the 35-ft. furnace. The company has two Dwight & Lloyd sintering machines, which are used in preparing flue dust, fine ore and small shipments of concentrates for blast-furnace charging. There are no reverberatory furnaces at this plant, nor converters, though the installation of two converters of the Great Falls type has been under consideration. The plant is situated at Thompson, Nev., and was built to handle primarily the ores from the Mason Valley mine in the Yerington district, but does a general custom-smelting business, the largest individual custom shipper being the Nevada-Douglas Copper Co. in the same district. The operation is of much importance to that section of Nevada, and during the last year over 125 properties situated within a radius of 300 miles shipped to this plant.

Pig Iron Production in 1912

The statistical bureau of the American Iron & Steel Institute has completed its collection of figures from the furnaces and reports that the total production of pig iron in the United States in 1912—every furnace having reported—was 29,727,137 long tons, being an increase of 6,077,590 tons, or 25.6%, over 1911. The accompanying table 1 gives the production by half-yearly periods for five years:

TABLE I. PRODUCTION BY HALF-YEARS

Periods	1908	1909	1910	1911	1912
First half	6,918,004	11,022,346	14,978,738	11,666,996	14,072,274
Second half	9,018,014	14,773,125	12,324,829	11,982,551	15,654,863
Total	15,936,018	25,795,471	27,303,567	23,649,547	29,727,137

The production in the second half of 1912 was greater than that of the first half by 1,582,589 tons. The make of pig iron in 1912 was the largest ever reported in a calendar year, but it was still nearly 25,000 tons less than that for the 12 months from July 1, 1909, to June 30, 1910, which reached a total of 29,751,863 tons. The make for the second half of 1912, however, was the largest ever reported for a half year.

Table II gives a production of pig iron classified according to the purposes for which it was intended. The main point to be noted in this table was that production of basic pig for the first time exceeded slightly that of bessemer iron. It may be added that the table includes a small quantity of ferrophosphorus, ferrotitanium and other alloys, which are not stated separately. The charcoal iron also includes a few tons made in California in the electric furnace.

TABLE II. PRODUCTION OF DIFFERENT KINDS OF IRON

	1911		1912	
	Tons	Per Cent.	Tons	Per Cent.
Foundry and forge	5,256,830	22.2	6,096,254	20.5
Low phosphorus	282,460	1.2	282,359	1.0
Bessemer	9,126,843	38.6	11,385,297	38.3
Basic	8,520,020	36.0	11,394,477	38.3
Charcoal	278,676	1.2	347,025	1.2
Spiegeleisen	110,236	0.5	96,346	0.3
Ferromanganese	74,482	0.3	125,379	0.4
Total	23,649,547	100.0	29,727,137	100.0

Table III gives the production of iron classified according to the fuel used. It will be seen that almost 98% of the iron made is with coke as fuel. Only two or three small furnaces use raw bituminous coal and nearly all the so called anthracite furnaces use some proportion of coke, so that coke may be called practically the universal iron-making fuel. Charcoal is still employed to a small extent, but only where the local conditions favor a supply of that fuel.

TABLE III. PRODUCTION BY FUELS USED

	1911	1912	Changes
Coke	23,141,296	29,135,527	I. 5,994,231
Anthracite and coke	212,548	233,873	I. 21,325
Anthracite alone	17,027	10,712	D. 6,315
Charcoal	278,676	347,025	I. 68,349
Total	23,649,547	29,727,137	I. 6,077,590

Production by States

Table IV shows the production of pig iron by states for three years past. It does not call for any special comment. The large increase in Indiana and Michigan is, of course, due to the new furnaces at Gary. Southern production has gained rather slowly and is still below

TABLE IV. PRODUCTION BY STATES

	1910	1911	1912
Massachusetts and Connecticut	16,582	9,694	17,366
New York	1,938,407	1,562,756	1,939,231
New Jersey	264,781	40,663	36,876
Pennsylvania	11,272,323	9,807,073	12,551,959
Maryland	326,214	255,816	219,546
Virginia	444,976	293,642	256,167
Georgia and Texas	14,725	1,200	.....
Alabama	1,939,147	1,712,211	1,862,909
West Virginia	174,661	291,472	274,360
Kentucky	100,509	95,202	68,760
Tennessee	397,569	324,648	338,238
Ohio	5,752,112	5,310,506	6,802,637
Illinois	2,675,646	2,108,002	2,887,359
Indiana and Michigan	1,250,103	1,163,932	1,770,628
Wisconsin and Minnesota	307,200	276,807	303,370
West of Mississippi	428,612	395,968	397,731
Total	27,303,567	23,649,547	29,727,137

that of 1910. The increase in New York was due chiefly to the furnaces at Buffalo. The production west of the Mississippi is principally in Colorado.

On Dec. 31, 1912, there were 313 stacks in blast and 153 idle, against 266 in blast and 200 idle on June 30, 1912, and 235 in blast on Jan. 1. During the second half of 1912 the number of furnaces actually in blast during a part or the whole of the six months was 337 against 302 in the first half of the year. Only one entirely new furnace was completed in the second half of 1912, the charcoal furnace of the Stephenson Iron Co., in Michigan. At the close of the year there were seven coke furnaces in course of construction, all of which it is expected will be completed in 1913. At the same time eight old furnaces were being rebuilt. In the year 1912 one charcoal and seven old coke furnaces were dismantled.

CORRESPONDENCE AND DISCUSSION

Cripple Creek in the Early Days

The short reminiscence of Mr. Sheldon in the JOURNAL of Jan. 25, 1913, entitled "Cripple Creek in the Early Days," recalls my own connection with that wonderful camp, but as one of the assayers of Leadville at the date mentioned by Mr. Sheldon, I must take exception to Mr. Sheldon's statement that the samples sent from Cripple Creek to Leadville for assay, were probably run by the "lead pencil" or "back door" method, simply because the returns were low. While such methods are known to exist—even aside from the question of honesty involved—there were too many checks upon the assayer for him to practice rendering an assay certificate without having performed the work, unless he was both knave and fool. If he was a fool he could not long have existed in Leadville, for no keener, sharper and better set of men were to be found in any mining camp, and while a number of them have "passed over the range" there are others who are at the head of some of the largest and most influential concerns in the country, and at least three of those same assayers are today at the head of New York enterprises of no small magnitude. That two, or several distinct assays are nearly always obtainable from the same mine, or even a single pile of rocks, is too well known a fact to justify the statement, and is corroborated by Mr. Sheldon in his allusion to the high-grade ore in the Annie Lee mine, so rich that a few sacks of it materially helped to defray the expenses of the lawsuit in which the claim was at the time involved. Alongside of this ore was the low-grade which, when extracted, formed the waste dumps of $3 and $10 ore—worthless at the time, but later all milled and returning exceptional profits, and this same type of ore is today returning a dividend profit with a value of only $2.50 per ton. Why should the Leadville assayer be called dishonest because he gave a $3 assay, when millions of tons of the same grade of $3 per ton, have since the "early days" attested to his honesty and the assay value quoted.

The Leadville assayer was not an angel and never considered himself in that class, even though he was much nearer to them, if altitude is in their direction, than others lower down. The assayer of Leadville's pioneer day was as honest then as now. He was not too good to take a hand at faro but if he did any gambling it was straight. So clean were his methods that his employer would often stand behind his chair at night and watch his play without feeling there was a dishonest hair in his head. When he took a hand at gambling he generally went at it with the same determination to play fair as he did in making his assays; he was too big a man to rob the prospector of a $3 assay with the possibility of also losing to him a mine. No, Mr. Sheldon, I believe I have a better right to "call your statement" and assert that it was not a "back-door assay," than you have to make it. I will grant you the possibility that the assayer may have returned a "trace" or "no value" on account of his not being accustomed to assay for gold alone, if a gold assay was not specially called for, which is highly probable, as most of the prospecting and assaying was done for silver in those days, and a "prill" of gold from the weight of sample used for a silver assay would be so small as to be placed as a "trace," or lost entirely in the bone ash of the cupel. As I hauled the first machinery over the snow into Cripple Creek, and built and operated the first sampling works of the district, I have reason to know of the different assays in almost the same rock, which is a characteristic of that camp as well as Leadville, and can hardly be classed as a "tenderfoot" in experience or opinion upon the subject.

H. W. HARDINGE.

New York, Jan. 28, 1913.

The Butte Geological Report

I observe in the JOURNAL of Jan. 18, 1913, a communication by Walter Harvey Weed, relating to the Butte Geological Report—Professional Paper No. 74, U. S. Geological Survey—in which Mr. Weed states that:

> The report on this work was submitted for publication in 1907 and appeared five years later in book form. For this delay the author is not responsible, nor is the reason for it known to him. Litigation was responsible for delay in preparation, not publication.

Again, on the next page he reiterates that "litigation was responsible for delay in preparation of the report, not its publication, after the manuscript was submitted."

In this connection permit me to invite to the attention of your readers the plain record of the Butte Report, as shown in the official files of the Geological Survey.

On Nov. 27, 1906, Mr. Weed's resignation as a geologist of the Survey was accepted by Director Walcott, who at that time, in his letter to Mr. Weed, asked for a definite statement as to when the Butte report would be finished, and added: "I am particularly anxious that the Butte report should be published at an early date, and I trust you will find time to complete this report very soon." No reply to this letter is found in the files.

On July 15, 1907, Chief Geologist Hayes writes Mr. Weed that he is glad that he is in a position to resume work on the Butte report and hopes nothing will interfere. July 1 to Aug. 28, 1907, Mr. Weed was engaged on the preparation of the Butte report with salary on a per diem basis.

At this time also a stenographer was detailed to Norwalk, Conn., to assist in the preparation of the Butte report, and on Sept. 11, 1907, Mr. Weed writes the director that the stenographer can return to Washington on Sept. 16, but that he still has work to do on the manuscript.

Under Mr. Weed's direction, the stenographer made many changes in the report, at various times after her return from Norwalk, and there was considerable correspondence between S. F. Emmons and Mr. Weed in regard to these changes.

On May 20, 1908, as Director of the Survey, I asked the necessary fiscal authority from the Secretary of the Interior to purchase the Butte report at a cost not to exceed $1500, this being the amount estimated as fair compensation for Mr. Weed's work on the report after his separation from the government service.

On Jan. 19, 1909, the manuscript was received by the chief geologist and referred to Mr. Lindgren, the chief of the metalliferous section. It is believed that, in accordance with almost invariable custom, the report subsequently went back to Mr. Weed, at least in part, for revision in the light of expert criticism, but of this there is no definite record, although on July 18, 1909, Mr. Weed wired Mr. Lindgren from Butte, "Will Aug. 1, instead of July 25, fulfill contract?" It is believed that this telegram referred to the Butte report, and Mr. Lindgren's reply was "August first will do." Mr. Weed's letter of transmittal of manuscript bears date of Aug. 27, 1909, a few weeks less than three years before its publication.

On Jan. 27, 1910, Mr. Lindgren advised the director that the Butte report was ready for editing, and two days later the illustrations were received in the Section of Illustrations.

The formal transmittal of the report to the chief geologist by Mr. Lindgren occurred on Feb. 1, and the manuscript was received by the Survey editor on Feb. 12, 1910, at which time it was accepted for publication.

The work on this manuscript, however, continued, for it subsequently went to Mr. Lindgren on Feb. 24, and to S. F. Emmons on Mar. 1 in the same year, and is believed to have been sent to Mr. Weed for minor changes. Mr. Weed's preparation of the report, however, was finally finished at about this time, and on Apr. 4, 1910, he was paid the full balance due him on completion of his work, the voucher for such payment having been approved Feb. 14, 1910.

In a letter dated Aug. 25, and again on Oct. 6, 1910, Mr. Weed was informed that the illustrations had been prepared for the engravers and were ready for the author's inspection, but this necessary inspection by him was not made until Feb. 7, 1911; a delay of over five months, doubtless unavoidable, yet no less unfortunate. A few alterations were suggested by the author at this time. On Apr. 11, 1911, the report received its final approval by the director, and on the following day, went forward to the printer.

Another delay, of more than six months, for which again the Geological Survey was in no way responsible, was a consequence of the contract system under which illustrations for government reports are engraved and printed.

The lithographs, including the map which Mr. Weed criticizes, should have been delivered to the public printer by the contractor on Dec. 5, 1911, but were not all received until Mar. 18, 1912. Even then the maps referred to were so poorly printed that the editions were rejected and finally the contractor in default, finding himself unable to furnish prints at all satisfactory, asked to have reprints made for him on the presses of the Engraving Division of the Geological Survey. To have made new stones would have secured better results, but at so great a cost in added delay that this reprint edition was accepted on July 24, 1912, and immediately thereafter, Aug. 6, 1912, the completed publication was issued.

Three years is more than should be required for the publication of any report, and, in fact, is more than twice the average period elapsing between author and reader in the Survey's professional papers. However, three years is not five years, and I present this statement regarding the publication of the Butte report to show your readers that the completed manuscript was not forwarded to the Survey by Mr. Weed in 1907, and, also, that the difficulties inherent in the completion and publication of a government investigation are many times increased in those too frequent cases where an author,, with work unfinished, leaves the public service to engage in other pursuits which then claim his first attention.

GEORGE OTIS SMITH.

Washington, D. C., Jan. 29, 1913.

Lake Superior Iron Ore Leases

In the Annual Statistical Number of the JOURNAL, Jan. 11, 1913, in an article by Dwight E. Woodbridge, on the Lake Superior iron-ore district, several statements are made, which I know to be incorrect. On p. 85, Mr. Woodbridge states:

> . . . but (the price) is not greatly higher than has just been paid by the Northern Pacific road for a developed tract in the same township, which was sold at 70c. per ton. Just now these figures seem to be very high.

The tract referred to adjoins the Pennington mine on the west. The Pennington is now being stripped by the Tod-Stambaugh Co., and for all ores which they mine by the open-pit method they pay the assignors 80c. per ton.

Mr. Woodbridge's statement to the effect that the Northern Pacific road paid 70c. per ton is incorrect. I was a party in the negotiations for the tract. It has never been the policy of the Cuyuna Realty Co., which took this property, to pay high royalties, and this is so well known generally that statements like this one of Mr. Woodbridge would prove inimical to the interests of this company, and other parties, should it be allowed to go unchallenged. It is a matter of record that the lease provides for a 35c. royalty.

On p. 86, Mr. Woodbridge states:

> The Northern Pacific is preparing to construct a steel and concrete pier . . . . at Superior. It is apparent that the Northern Pacific road intends to go into the business of mining, either through its Northwestern Improvement Co. or by arrangement with outside interests.

Mr. Woodbridge certainly was wrong in the above statement, or else he failed to express himself clearly. Merely that the Northern Pacific road is building an ore dock is not indicative that it or any of its subsidiary companies is going into active mining. Being a common carrier, it simply handles ore as it would fruit, but to carry fruit it is not necessary to be in the fruit-raising business.

If the Northern Pacific Ry. or the Northwestern Improvement Co. controls mineral lands in fee or by lease, it is reasonable to expect that the properties will some day be mined, but as far as the Lake Superior district is concerned, these companies have not at any time been engaged in mining, and the present policy of the above companies, at least so far as their Minnesota iron-ore properties are concerned, is not to engage in mining themselves. I have represented these companies in the Cuyuna district for years.

CARL ZAPFFE.

Brainerd, Minn., Jan. 30, 1913.

EDITORIALS

The Secretaryship of the Institute

The charges that have been openly made against Doctor Struthers will compel him to seek a vindication. Such a vindication will not be obtained by a newspaper controversy or by a circularizing of the membership. There is never a case that does not have two sides and before judgment is rendered both should be heard. They should, however, be heard in a proper way.

The correct course for Doctor Struthers to follow is to demand an inquiry by the board of directors of the Institute. He ought not to want a vindication merely by being elected secretary, which would not be a vindication at all, and the Institute will not want a secretary against whom lay unsettled charges.

The correct course for the membership in this juncture is to vote for the amendments to the constitution and by-laws now before it. Also to vote for the nominees for officers and directors on the ballots that have been issued, each member selecting those names for directors in which he has confidence.

The amended constitution will abolish the old dual system of government, which was a bad system. It will also give the membership a good deal of a say in its own affairs, which it ought to have.

The important thing now is to insure the passage of the amendments. Every member should attend to voting upon these. If passed, the board of directors will elect the secretary and it may be relied upon to perform that duty with fairness, judgment and an intelligent knowledge of all the facts.

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Modern American Rock Drill Practice

The recent installation of one-man drills in the Calumet & Hecla mine brought forth rather wide-spread comment on drilling practice in mining operations. The one-man drill for stoping has long been standard in the Western mining districts, but the Michigan copper country is tenacious of old customs and the successful introduction there of this more economical drilling method marks another triumph of the light drill over the heavy.

Three types of machine drills are now well recognized: The piston drill, always mounted, with reciprocating drill bit attached rigidly to the piston rod, automatically rotated and fed by hand, and with the cuttings removed by gravity or by the churning of the bit in water introduced at the collar; the hammer drill, always mounted, in which the bit does not reciprocate, but is automatically rotated and fed by hand, the cuttings being removed by a stream of air or water through the steel, the piston striking the shank of the steel a blow similar to that delivered by a hammer on the head of a nail; and the "jackhammer" or "plugger" drill, always unmounted, in which the bit does not reciprocate but is rotated by the operator and is fed by the weight of the machine and the operator, the cuttings being removed by gravity or by a stream of air or water through the steel. As such it is essentially a one-man tool, held in the hands, progress being made either through the weight of the drill, or through the pressure by the operator, or both.

The hammer drill proper is suitable only for drilling upwardly slanting holes and consequently finds its field of usefulness, especially in stoping, whence the name "stoper" often applied to these drills. The jackhammer, on the contrary, cannot very well be used for upward holes on account of the inconvenience to the operator, who holds it without support, but as a tool for drilling down-holes it is marvelous. At present it is being employed in shaft sinking at the Newport mine, in Michigan, and we hear with highly economical results. The men take these instruments with them just as they used to take hammer and steel in olden days and save the time of rigging and unrigging the heavier machine drills, with obvious advantage. So far as we are aware the shaft sinking at the Newport mine is the first use of the jackhammer in such work.

Each of these types of drill has its special field. In drifting, the piston and the hammer drill divide the field, the two-man or one-man size being required, according to the difficulty of the ground. In sinking, the piston drill is still preëminent, but the hammer drill, and especially the jackhammer, have been rapidly winning favor even for steep down-holes, and the jackhammer is being successfully used in shaft sinking as we have stated previously in this article. In raising, the hammer drill or "stoper" is at its best, but in work rising at a low angle the piston drill is still supreme. In stoping, the choice is determined according to the nature of the deposit. If the deposit is flat, or is taken off in flat benches, then the piston drill is a logical choice. If it is steep, comparatively narrow, mined by overhead stoping, the hammer drill is much superior. If glory-hole methods can be adopted, the jackhammer will probably be selected. There is always a large class of deposit on the border line, such as the rather flat, narrow veins like that of the North Star mine in California, where the choice of the most economical drill is ever a debatable question.

In some of the Michigan copper mines the small drills have contributed to remarkable results. In these the old type of piston drill has been gradually replaced by a newer and later type of piston drill, which is partly, if not entirely, a one-man machine. Recent figures in bench or footwall work have shown that the cost of mining with this light piston drill is about 56c. per ton, each machine giving about 11½ tons per man per shift. With the hammer drill, the cost per ton in the same, or similar, material, is reduced to about 45c., each man producing about 12½ tons per shift. In work where the jackhammer can be used to advantage it is obvious that a still greater efficiency ought to be obtained because of the saving of time in carrying and mounting the drill. In fact, increased efficiency is actually realized, and to a high degree, the cost per ton with the jackhammers being

about 15c., each man producing about 36 tons per shift. This refers, of course, to bench work, not shaft sinking.

In these comparative figures of cost no overhead charges are included, nor charges for air, but everything else is reckoned, i.e., labor, explosives, general supplies and machine-repair costs. Overhead charges vary at each mine and with each organization. The cost of compressed air also is variable, according to cost of coal, type of compressor used, etc. In a general way it may be assumed that it costs from 50c. to $1 per 24 hours per drill for compressed air. With the jackhammers the cost of compressed air is reduced by approximately one-half as compared with the other types of drills.

The old type of piston drill weighs about 250 lb., the newer and lighter piston drill about 150 lb., the jackhammer only about 60 lb. Naturally its lighter weight and the usage to which it is subjected result in a shorter life, but its first cost is only a little more than half of that of the piston drill and its efficiency is so much greater that it is economical to adopt them, wear them out, and substitute new ones as required.

Some marvelous work in reducing mining costs has been done in the Michigan copper country during recent years and this has been achieved largely by the introduction of improved methods of drilling and improved drills, in which the manufacturers have rendered highly valuable assistance to the mine engineers. It is reported that within two years the old two-man drill will be displaced in nearly every mine in the Lake Superior district, the change being made rapidly in nearly all of the Calumet & Hecla mines and in many others this winter.

The American Institute of Mining Engineers

Many members of the institute from the West and elsewhere, visiting us, have asked "What is beneath all this talk in the institute?" The members who have, within the last week, received the same sheaf of ballots that have come to us, have experienced confusion and asked for explanation.

About a year ago, when the management of the institute proposed summarily to raise the dues, 20 members united in organizing an opposition to that plan. Their idea was to look into the affairs of the institute in an exhaustive and unprejudiced way. They did not have any suspicion of malfeasance. The thought was rather to see whether modern methods were applied and highest efficiency realized.

In response to their call for proxies, many members wrote letters expressing opposition to Doctor Struthers, and commanded the proxy holders to vote against him at the forthcoming annual meeting. The insurgent committee had not asked for such instructions and in the meeting was not prepared to act discriminatingly and consequently in the matter of the secretaryship decided to refrain from voting.

At this annual meeting, all parties united in deferring the proposal to increase the dues and in appointing an investigating committee of five, of which Mr. Corning became chairman.

During the studies of this committee innuendoes began to be circulated to the purport that scandalous things in the management of the institute were being discovered. In May, a draft for a report, then already overdue because only one member of the committee had been found to sign it, was exhibited to several persons and then for the first time it was learned, outside of the committee, specifically respecting what was supposed to have been found. Many of the statements in this draft were evidently regarded as immaterial, or inconsequential, or unproved, or intemperate. Anyway, a majority of the committee was unwilling to sign it.

Later, through the hand of Doctor Ledoux especially, the draft was reduced to such form that all members of the committee of five signed it and it was published. All subsequent hints and innuendoes of a suppressed report were unfounded. There never was any report of the committee of five except what was published, inasmuch as a majority of its members would not sign any previous draft.

All of this is ancient history, which would not need to be reviewed were it not that present controversies hark back to it. The committee nominating officers for the ensuing year received many letters urging Doctor Struthers for secretary and many urging other persons. It is rumored that the threat was made to this committee that if it or anybody else should nominate Doctor Struthers, certain damaging statements, based upon unpublished findings of the committee of five, would be made against him in the *Mining and Scientific Press*. The nominating committee put up the name of Bradley Stoughton, but the aforesaid threats coming to the ears of Doctor Struthers and his friends, they made an independent nomination of him, challenging an unnamed paper and the *Mining and Scientific Press* took up the gauntlet and made specific charges, which pertain especially to the management of the institute excursions.

We have previously expressed the opinion in strong words that the institute excursions as heretofore conducted should be abolished. They have led to a variety of evils and the revelation last year that financially they were run personally by the secretary, not by the institute, was a surprise and a shock to most of the members. However, the governing body of the institute, not the secretary, has been responsible for this system. Before passing opinion upon the conduct of the secretary in connection with these excursions, both sides should be heard, and in fairness it should be stated that it is of record that he requested to be excused from running the Japan excursion, that the directors begged him to run it and that the subsequent complaints and charges against him in connection with that trip were considered by a committee of the board of directors and he was exonerated.

The charges that are now made reflect seriously upon Doctor Struthers, and we suppose he will meet them. We desire only to point out to the members of the institute that at present they are unproved, are not among the findings of the committee of five, and judgment respecting them ought to be deferred until such time as he may obtain a judicial consideration of them, which, no doubt, he will seek as soon as possible.

As between Mr. Stoughton and Doctor Struthers, we advise members of the institute to vote according to their preference. The voting for these gentlemen is effective only if the pending constitutional amendments are defeated, and may be done (if the member be not present in person) only by executing the white or the green proxy, the former for Mr. Stoughton, the latter for Doctor Struthers.

Considering that the constitutional amendments may be carried, the members have been provided with two alternative ballots, neither of which contains a nomination for secretary, because under the new constitution the secretary will be elected by the board of directors.

Amid all this confusion, the simple instruction is: (1) For *all* members to vote either ballot *C* or *D*, and inclose it in the official envelope as directed; and (2) for members not intending to be present at the meeting *also* to execute either the white or the green proxy. The white proxy will mean a vote for Mr. Stoughton, the green for Doctor Struthers. These proxies will be voted only if the constitutional amendments fail. The present prospect is that the proxies will not be voted at all.

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The Prospect for Copper

The price for copper may go still lower before there is any upward reaction. Yet the economic position of the metal is really sound. For the moment, however, there is a bad technical position, resulting from the manipulation of 1912, and this may be accentuated by bull-headedness. The sooner some leading producers forget the idea of starving consumers and allow economic nature to pursue its course, the better it will be for them as well as for everybody else. The pegging of the price at 16½c. is only a little better than at 17¾c. It is exactly from that policy that the market is now suffering.

There does not appear to have been any restriction in consumption and there is manifestly a lot of buying to be done, but manufacturers do not buy willingly in so unsettled a market and confine themselves to covering hand-to-mouth requirements and buy in driblets from the producers and speculative interests who meet them. Dealers who are able to buy cheaply of crude copper in London and bring it over here to be refined naturally are willing to sell refined cheaply against it, and similarly in other sorts of arbitrage transactions. It is surprising how much copper from so called second hands is in the market. Thus the situation is kept unsettled and prices crumble and a bad situation is being developed by the refusal of some of the big producers to make a market instead of holding aloof for the buyers to come to them, forgetting that 16½c. is still a high price for copper. A year ago everybody was looking ahead to 15c. as a goal that would satisfy all desires.

Yet the intrinsic position of copper looks sound enough. Consumption in 1913 is quite likely to outrun production once more. Production now is not increasing, but rather is falling short of the maximum in 1912, and there is no great volume of new production impending. The American refinery statistics for January will doubtless show a further increase in stocks, but these figures tell only part of the statistical story and ought not to be made the basis of too sweeping conclusions. The cure of the copper market will come from a cessation of manipulative meddling and the free operation of the law of supply and demand.

We are not going to have a renewed rise in the metal ending with 20c., or whatever may be fancied, starting from the basis of 16½c. Whatever rise may come later will start from a lower basis than that. Some attention ought to be paid also to the opinions of economists, not yet antiquated, that 14@15c. is a good average price for copper.

BY THE WAY

The automobile is commonly considered to be a mechanical vehicle of short life, but some of the machines that have experienced hard usage around the mining camps of Nevada have mileage records that make the average Eastern operator envious. However, these Nevada figures are far exceeded by the records of some of the motor trucks. A Mack motor truck in Washington, D. C., is reported to have attained a mileage of 142,728. In Wilkes-Barre, Penn., one has gone 175,000 miles. A Saurer truck, in Switzerland, is reported to have gone 225,000 miles.

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The U. S. Post Office and the Department of Justice have been so intelligently and efficiently active for the last few years that this country has become distinctly unhealthy for the get-rich-quick mining promoter. In Canada, however, one Charles H. Brooks has recently been running a series of advertisements in the Vancouver *World*, setting forth the incomparable opportunity offered the small investors of that region to buy the stock of the Golden Plate Co., Ltd. This richly entitled company, which boasts Mr. Brooks for its managing director, controls the Golden Zone group near Hedley, B. C. The honest camp of Hedley does not relish the crown of glory that Mr. Brooks would thrust upon it, if the Hedley *Gazette* is a fair spokesman. That weekly journal publishes some rather tart comment on the situation, in which mechanics' lien suits for unpaid wages figure largely. Mr. Brooks, in his advertisements, gives many figures which are correct but not pertinent, and fails to say anything on such subjects as tonnage, development, sample widths, and sample locations. He describes his previous mining life in highly colored style, but does not mention certain unpleasant experiences that once befel him in Boston.

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Andrew Carnegie and his "boys" certainly must have been very careless at times, if statements made in the January *Scribner's* by one John Finley in an article entitled "The French in the Heart of America," can be accepted at face value. This authority says, speaking of recent features in the development of the iron industry about Pittsburgh: "One ironmaster found, I am told, 90% of pure iron in the refuse of his competitor." Not much competition evidently! This same authority graphically and lucidly (?) describes the process of iron making: "In furnaces heated to a thousand degrees or more the red earth is freed of its devils, as the great ironmaster has named the sulphur and phosphorus—freed of its devils as the red man was freed of his sins by the touch of the holy water out in those very forests from which the red ore was digged—then comes forth purified, to be cast into flaming ingots, to be again heated, and then crushed, and moulded and sawn and pierced for the better service of man. In the course of a few minutes, one sees a few handfulls of ore that were a month ago, before lying in the earth beyond Superior, transformed into a girder," etc. The excuse for feeding the lay reader on such loose, lazy and ludicrous stuff in the guise of literature is certainly a cardinal sin from the standpoint of good editing—and *Scribner's* is supposed to be well edited!

January Mining Dividends

Dividends paid by 39 United States mining companies in January, 1913, amount to $7,595,709 as against $6,804,065 reported by 21 for the same period last year. Dividends for 26 Canadian and Mexican companies total $3,672,144, no less than nine Mexican companies being represented with a dividend total of $989,929. The total reported last January by Canadian and Mexican companies was $1,181,333.

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	7.00	350,000
Anaconda, c	Mont.	0.75	3,249,375
Am. Zinc, Lead & Sm. l.z	U.S.	0.50	83,220
Bunker Hill Con., g	Calif.	0.05	10,000
Bunker Hill & Sullivan, l.s	U.S.	0.20	65,400
Camp Bird, g. s	Colo.	0.24	267,300
Champion, c	Mich	1.00	100,000
Cliff, g	Utah	0.10	30,000
Continental Zinc, z	Mo.	0.50	11,000
Copper Range Con., c	Mich.	0.75	295,084
Daly West, s.l	Utah	0.15	27,000
Center Creek, z	Mo.	0.05	5,000
Fremont, g	Calif.	0.02	4,000
Frontier, z	Wis.	2.00	2,500
Golden Cycle, g	Colo.	0.02	30,000
Grand Central, g	Utah	0.05	25,000
Hecla, l. s	Ida.	0.02	20,000
Homestake, g	S.D.	0.65	141,960
Iron Blossom, s. l. g	Utah	0.10	100,000
May Day, g. l. s. z	Utah	0.02	16,000
Moscow, g. s. c. z	Utah	0.01	8,000
Mary McKinney, g	Colo.	0.02	26,185
North Butte, c	Mont.	0.50	205,000
Old Dominion, c	Ariz.	1.25	202,500
Opohongo, g. s. l	Utah	0.02	17,980
Osceola, c	Mich.	3.00	288,450
Portland, g	Colo.	0.02	60,000
Shannon, c	Ariz.	0.50	150,000
Shattuck-Arizona, c	Ariz.	0.50	175.000
Tonopah-Belmont, g.s	Nev.	0.25	375,000
Tonopah Extension, g.s	Nev.	0.02½	23,586
Tonopah Mining, g. s	Nev.	0.40	400,000
Tom Reed, g	Ariz.	0.07	63,669
Tennessee, c	Tenn.	1.50	300,000
United Globe, c	Ariz.	7.50	172,500
United Verde, c	Ariz.	0.75	225,000
Vindicator, g	Colo.	0.03	45,000
Wasp No. 2, g	S. Dak.	0.01	5,000
Yellow Pine, z. l. s	Nev.	0.02	19,000

Iron, Industrial and Holding Companies	Situation	Per Share	Total
Am. Agr. Chem. com	U.S.	1.00	171,141
Am. Agr. Chem. pfd	U.S.	1.50	275,730
Am. Sm. Sec. pfd. A	U.S.Mex.	1.25	375,000
Am. Sm. Sec. pfd. B	U.S.Mex.	1.50	255,000
Colo. Fuel & Iron, pfd	Colo.	2.50	50,000
Empire Steel & Iron, pfd	Penn.	2.00	50,000
General Chem. pfd	U.S.	1.50	150,000
Harbison-Walker, pfd	Penn.	1.50	144,000
Guggenheim Expl	U.S.,Mex.	0.62½	519,832
Inter. Agr. Corp., pfd	U.S.	3.50	630,000
La Belle Iron Works	Ohio	0.50	49,577
Lackawanna Steel, com	U.S.	1.00	349,780
Mines Co. of America	Mex.	0.12½	112,500
National Carbon, com	U.S.	1.50	82,500
Old Dominion, c	Ariz.	1.25	366,555
Republic I. & S	U.S.	1.75	357,296
Sloss Sheffield, pfd	U.S.	1.75	117,250
U. S. Gypsum, pfd	U.S.	1.25	53,592
U.S. Sm. Ref. & Min., com	U.S.Mex.	0.75	263,328
U. S. Sm. Ref. & Min., pfd	U.S.Mex.	0.87½	425,530
Virginia-Carolina, com	U.S.	1.50	419,776
Vulcan Detinning, pfd	U.S.	1.75	26,250

Canadian, Mexican and Central American Companies	Situation	Per Share	Total
Alacran, g. s	Mex.	2.00	19,200
British Columbia, c	B.C.	0.15	88,756
Buffalo, s	Ont.	0.23	230,000
Blanca y Anexas, g. s	Mex.	0.90	11,250
Cobalt Lake, s	Ont.	0.02½	93,875
Crown Reserve, s	Ont.	0.05	88,441
Dominion Steel	Ont.	1.00	345,896
El Favor, g. s	Mex.	0.01	35,000
Esperanza, s	Mex.	0.36	165,847
Hollinger, g	Ont.	0.03	87,500
La Rose, s	Ont.	0.25	374,656
Le Roi No. 2 g	B.C.	0.36	43,740
Lucky-Tiger, g	Mex.	0.07	50,074
McKin.-Darr.-Sav., s	Ont.	0.20	449,538
Nipissing, s	Ont.	0.37½	450,000
Norias de Bajan, s	Mex.	0.50	1,000
Nova Scotia S. & C., pfd	N.S.	2.00	20,600
Nova Scotia S. & C., com	N.S.	1.50	90,000
Rio Plata, s	Mex.	0.05	18,696
Santa Gertrudis, s	Mex.	0.48	664,862
Santa Maria de la Paz, g. s	Mex.	2.50	24,000
Standard Silver-Lead	B.C.	0.02½	50,000
T. & H. Bay, s	Ont.	3.00	23,383
Temiskaming, s	Ont.	0.03	75,000
Trethewey, s	Ont.	0.10	100,000
Wettlaufer, s	Ont.	0.05	70,830

In the preparation of the table of industrial companies we have omitted this year all coal companies except such as carry on an iron-ore smelting business in addition, while we have collected statistics from a greater number of iron-ore smelters, rendering this year's figures non-parallel with the 1912 reports.

Ahmeek, Copper Range Consolidated and Tennessee show the effect of the high-copper prices prevailing, by increasing their dividends, while Shannon paid for the first time in five years, and Shattuck-Arizona for the first time in two. Another old-timer to come back was May Day in Utah. Homestake increased its dividends, and there seem to have been no decreases.

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Chronology of Mining for January, 1913

Jan. 1—National Zinc Co. took over the Springfield, Ill., works of United Zinc & Chemical Co. under a long lease.—Eight of nine miners, imprisoned behind a cave-in, caused by a rush of water, in the East Lehigh coal mine, at Tamaqua, Penn., were recovered alive.

Jan. 2—Announcement of court order, approving foreclosure of $2,500,000 mortgage of Continental & Commercial Trust & Savings Bank, of Chicago, on property of Pennsylvania-Wyoming Copper Co., in Wyoming.

Jan. 3—Three miners killed in Imperial mine, near Joplin, Mo., by failure of engine to hoist them away from a blast.

Jan. 7—Fall of roof in Old Jordan mine, Bingham, Utah, killed three men.—Main building of the Canada Refining & Smelting Co., at Orillia, Ont., destroyed by fire.

Jan. 23—Labor strike over discharge of two men at Witherbee, Sherman & Co.'s iron mines, at Mineville, N. Y., reduced the output for a short period, production being nearly normal by the end of the month.

Jan. 25—Reported sale of the Dominion Nickel-Copper Co.'s holding in Sudbury, Ont., to the F. S. Pearson interests.

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American Institute of Mining Engineers

The 104th meeting of the American Institute of Mining Engineers will be held in New York, beginning Feb. 17, 1913, with headquarters at the Institute office, Engineering Societies Building, 29 West Thirty-ninth St. The program of the meeting will be as follows:

Monday, Feb. 17, 8:15 p.m., informal social meeting and smoker.

Tuesday, 10 a.m., annual business meeting; 12:30 p.m., luncheon at Engineering Societies Building; 2 p.m., technical session, papers on mining and geology; 8:15 p.m., address on irrigation, by F. H. Newell, Director U. S. Reclamation Service.

Wednesday, Feb. 19, 10 a.m., technical session, on iron and steel; 12:30, luncheon; 2 p.m., technical session, on iron and steel; 7 p.m., formal president's reception.

Thursday, Feb. 20, 10 a.m., technical session, if needed.

Concerning the questions to come before the business meeting and official ballots, see the JOURNAL of Jan. 18, 1913, p. 196. Details of the technical sessions will be given later in the program of the local committee.

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A Junior Topographer is being advertised for by the U. S. Civil Service Commission, Washington, D. C., to fill vacancies as they may occur in the Geological Survey, at salaries ranging from $720 to $1200 per year. Examinations for this position will be held in various cities on March 6 and 7, 1913. Applicants should apply immediately for Form 1312, which must be accompanied by a medical certificate, and filed with the commission at Washington.

PERSONALS

Thomas H. Leggett is in New Mexico.

C. R. Corning has returned from Europe.

Waldemar Lindgren has left Boston for Zimapan, Hidalgo, Mexico.

Frederick P. Burrell left New York last week for the Northwest and Alaska.

Alden H. Brown, of New York, will leave soon for Cuba, to make some mine examinations.

Frederick W. Moffett, manager of the Statehood mine at Hillsboro, N. M., is in New York.

Kirby Thomas will shortly leave New York for examinations in New Mexico and Arizona.

C. H. Plumb, of Joplin, Mo., has been in New York in connection with the sale of some zinc mines.

R. A. F. Penrose, Jr., has gone to Europe, where he expects to remain during two or three months.

C. N. Henrotin has resigned as superintendent of mines for the Canadian Copper Co. at Copper Cliff, Ontario.

Karl Eilers has gone West on a periodic tour of inspection, expecting to return to New York about the end of March.

W. L. Saunders, president of the Ingersoll-Rand Co., has also become president of the new International Harvester Company.

Homer L. Carr sailed from New York, Feb. 5, for Colombia, where he will be engaged for several months in placer examinations.

E. B. Gage, formerly president of the Tombstone Consolidated Mining Co., is reported very ill at his residence in San Francisco.

Luther Kemper, of Webb City, Mo., has gone to Mascot, Tenn., to a mine which the American Zinc, Lead & Smelting Co. is opening there.

G. E. Drewett has returned to Sydney from the Gilbert & Ellice group, where he has been examining the phosphate formations.

Richard K. Meade has opened offices and laboratories at 202 North Calvert Street, Baltimore, Md. He will make a specialty of lime and cement plants and properties.

Shirley Baker, for some time managing engineer of the pipe department of the Redwood Manufacturing Co., has been appointed construction engineer of the Panama-Pacific International Exposition.

J. C. Simmons, deputy mineral surveyor, of Telluride, Colo., who has been in New York for several weeks making an investigation of vanadium treatment processes, has returned to Colorado and will resume work on the properties of the Colorado Vanadium Co. at Newmire.

E. A. Collins has been appointed inspector of mines by the Mines Department of Ontario. He will be stationed in the eastern part of the province, having in his territory, the gold mines of Hastings County, the smelting works at Deloro and all quarries.

Sailing, Feb. 1, with F. Lynwood Garrison for Barranquilla, Colombia, were the following engineers who will drill the Breitung hydraulic and dredging ground in the Cauca Valley: H. L. Mead, resident engineer; H. B. Barling, assistant; L. Hoffman and H. R. Griffen, junior engineers. With the Breitung party, also, were T. J. Anderson and E. F. Wilson, drillers; and R. Kimble, auditor. Drilling machinery has been shipped and the party will also have at its disposal two motor boats and a speedy hydroplane.

OBITUARY

Stephen S. Palmer, for many years president of the New Jersey Zinc Co. and later chairman of the board of directors, died Jan. 29 at Redlands, California.

P. L. Sigel died at Denver, Colo., Jan. 30. For a number of years he had been in the habit of grub-staking prospectors, and had acquired a large interest in mines.

Henry C. Mosenthal, an English chemist widely known for his work on explosives and for many years technical secretary of the Nobel Dynamite Co., died Dec. 18, aged 62 years.

Ephraim E. Confare, who founded the Indiana Wire Co., Indianapolis, Ind., in 1897, died at his home in that city Jan. 16. He was born in Ohio in 1837, but spent the greater part of his life in Indiana.

Henry Davey died at Tuttletown, Calif., Jan. 7. He was 63 years old, born in England, and went to Colorado about 30 years ago, and to California about 14 years ago. He was prominent in the mining industry in Tuolumne County.

Arthur Crozier Claudet died in London, Jan. 17, aged 57 years. He was the head of the well known firm of assayers and metallurgists established in London for many years, he having succeeded his father in that position on the death of the latter in 1905. The firm has long been assayers to the Bank of England, the Royal Mint Refinery, etc. Mr. Claudet was an original member of the Institution of Mining & Metallurgy, of which he was treasurer from its foundation to the day of his death. He filled the presidential chair in 1905-6, was one of the trustees and took the most active interest in everything connected with it. He was a member of the Bessemer Memorial Committee, the Advisory Board for the Royal School of Mines, of one or two sub-committees of the Imperial College and the Imperial College Union, and served from time to time on many other technical and educational bodies.

SOCIETIES

Lead & Zinc Association of the United States—This association was organized at Spokane as a chapter of the American Mining Congress. The chief object of the organization is to prevent a reduction of the tariff on the two metals. Officers were elected as follows: H. F. Samuels, Wallace, Idaho, president; W. B. Shackelford, Webb City, Mo., first vice-president; J. P. Peng, Galena, Kan., second vice-president; Otto Ruhl, Joplin, Mo., secretary-treasurer. The following compose the board of directors: J Labarthe, Thompson, Nev.; John A. Finch, Spokane; S. D. Nicholson, Denver; A. Underhill, Mascot, Tenn.; C. W. Estis, Galvil ., Ark.; T. McCarthy, Wallace, Idaho; W. R. Allen, Butte Mont.; E. J. Vest, Galena, Kan.; J. P. McNaughton, Miami, Okla.; W. W. Shackelford, Webb City, Mo.; Ernest Bamberger, Salt Lake City; Arthur M. White, Dallas, Tex.

American Mining Congress—The annual meeting of the Colorado Chapter of the American Mining Congress was held in Denver, Jan. 21. The retiring president, D. W. Brunton, delivered an interesting and instructive address. The following officers were elected: Governor, S. D. Nicholson, Leadville; first lieutenant governor, J. M. McClave, Denver; second lieutenant governor, A. L. Burris, Cripple Creek; third lieutenant governor, Bulkeley Wells, Telluride. Executive Committee: V. C. Alderson, Golden; R. L. Martin, Central City; Thomas Tonge, Denver. Secretary and treasurer, E. L. Wolcott, 725 Majestic Building, Denver. Directors: D. W. Brunton, Denver; F. W. Bosco, Creede; E. A. Colburn, Denver; R. D. George, state geologist, Boulder; A. W. Harrison Silverton; R. M. Henderson, Breckenridge; Irving Howbert, Colorado Springs; W. E. Renshaw, Idaho Springs; John T Roberts, Jr., Ouray; G. S. Wood, Cripple Creek. Resolutions were adopted urging more general interest in the mining industry of the state, also providing for monthly meetings of the chapter.

American Electrochemical Society, New York Section—A meeting was held in New York, Feb. 7, in conjunction with the New York Section of the American Chemical Society and the Society of Chemical Industry. After the election of officers of the N. Y. Section of the American Electrochemical Society, a symposium on "Alumina in its New Revolutionary Relations to Correlated Fields of Chemistry" was held, the speakers being as follows: E. A. Sperry, Introduction on the Bearing of Cheaper Alumina on New Possibilities of the Aluminum Industry; J. W. Richards, The Serpek Process for the Production of Alumina and Ammonium Salts; S. A. Tucker, The Relation of the Production of Alumina to the Fixation of Atmospheric Nitrogen; A. H. Cowles, New Developments in the Process for the Production of Alumina, Hydrochloric Acid, Caustic Alkalis, and a Hydraulic Cement from Clay, Salt and Lime (With lantern slides of the Sewaren, N. J., plant and an exhibition of products). L. S. Saunders, New Uses of Alumina in the Chemical and Metallurgical Industries. C. A. Doremus, F. A. J. Fitzgerald, C. M. Hall, P. Heroult and W. R. Whitney were present and participated in the discussion.

INDUSTRIAL NEWS

The Simplex Electrical Co. has changed its name to Simplex Wire & Cable Co., but there is no change of management or interest.

The Orenstein Arthur Koppel Co. reports that its general manager, A. Reiche, is now at the head office of the company in Berlin, Germany, in consultation respecting extensive improvements to be made this year at its plant at Koppel, Penn. The executive offices of the American organization are to be moved from Pittsburgh to Koppel.

The Smooth-On Manufacturing Co., Jersey City, N. J., is offering two new products. One is known as "Smooth-On Iron Cement No. 7" for waterproofing concrete. This finds use in making watertight sumps, tanks, engine pits, etc. Smooth-On Cement No. 8 has heat-resisting and bonding qualities and is intended for use as a protective coating on firebrick furnace walls and arches and in making tight joints between the bricks. Samples of these products can be obtained by sending name and business address to the manufacturers.

At the foreclosure sale of the West Allis and Reliance works of the Allis-Chalmers Co., held in Milwaukee, Feb. 3, 1913, there was but one bid, that of the reorganization committee, of $2,250,000. The reorganization committee represented $10,600,000 of outstanding bonds (95.1%), $14,148,000 of preferred stock (88.1%) and $17,216,000 of common stock (86.9%). The attorney of the minority stockholders protested against the sale because of pending claims in the Federal courts. Protest was formally noted by Judge Geiger, who will have to pass on the sale.

TRADE CATALOGS

E. I. du Pont Nemours Powder Co., Wilmington, Del. Pamphlet. Permissible explosives. Illustrated, 16 pages, 6x9 in.

Otis Elevator Co., 11th Ave. and 26th St., New York. Catalog. Incline railways, skip hoist machines. Illustrated, 28 pages, 6x9 in.

Chrome Steel Works, Chrome, N. J. Pamphlet. "Adamantine" chrome steel forged shells and tires. Illustrated, 24 pages, 4x8 in.

The Deane Steam Pump Co., Holyoke, Mass. Catalog D-218. Electrically operated mine pumps. Illustrated, 100 pages, 6x9 in.

C. W. Hunt Co., West New Brighton, N. Y. Catalog No. 12-9. Hunt noiseless gravity bucket conveyor. Illustrated, 64 pages, 7x9 in.

Austin Mfg. Co., Chicago, Ill. Catalog No. 27. Gyratory crushers, stone and ore-handling machinery. Illustrated, 68 pages, 7½x10½ in.

Pacific Tank, Pipe Co., Equitable Bank Building, Los Angeles, Calif. Catalog No. 10. Tanks and pipe. Illustrated, 40 pages, 4x8½ in.

The Numa Rock Drill Sharpener Co., 29 S. State St., Salt Lake City, Utah. Catalog. Numa rock drill sharpener. Illustrated, 7½x9½ in.

Edgar Allen American Manganese Steel Co., McCormick Building, Chicago, Ill. Bulletin No. 55. Steam shovel and dipper dredge repair parts. Illustrated, 18 pages, 6x9 in.

The T. L. Smith Co., Milwaukee, Wis. Catalog No. 250. Rock, ore and gravel handling machinery. Symons gyratory crushers, Smith jaw crushers, etc. Illustrated, 40 pages, 6x9 in.

Tate, Jones & Co., Pittsburg, Penn. Bulletin. "Blacksmithing and Drop Forging." Oil or gas fuel flue welding furnaces, blacksmith forges. Illustrated, 16 pages, 4½x7½ in.

Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 150. Coupled and belt types alternating current generators. Illustrated, 12 pages, 7x10 in. Bulletin No. 58. Adjustable speed motors. Illustrated, 12 pages, 7x10 in.

The Denver Quartz Mill & Crusher Co., Colorado Building, Denver, Colo. Catalog No. 10. Quartz mills, ore crushers, Kidd gold riffle and mercury traps. Illustrated, 24 pages, 6x9 in.

Edgar Allen American Manganese Steel Co., Chicago, Ill. Bulletin No. 52. Komata liner for tube mills. Illustrated, 18 pages, 6x9 in. Booklet. Electric special ground gears and pinions. Illustrated, 3½x6 in. Bulletin No. 53. Stag brand manganese-steel crane wheels. Illustrated, 12 pages, 6x9 in.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

TUNNEL FURNACE. Arthur Ramén, Helsingborg, Sweden. (U. S. No. 1,051,634; Jan. 28, 1913.)

ORE-REDUCING FURNACE. Peter Evert Peterson, Butte, Mont. (U. S. No. 1,051,512; Jan. 28, 1913.)

HOISTING DEVICE. Hugh W. Sessoms, Arlington, Wash. (U. S. No. 1,051,278; Jan. 21, 1913.)

ELECTRIC SMELTING. George Hillard Benjamin, New York, N. Y. (U. S. No. 1,051,065; Jan. 21, 1913.)

MINE-SHAFT LINING. Wilhelm Breil, Essen-on-the-Ruhr, Germany. (U. S. No. 1,051,076; Jan. 21, 1913.)

DRILLS—Rotator for Rock Drills. Charles T. Carnahan, Denver, Colo. (U. S. No. 1,050,806; Jan. 21, 1913.)

CONCENTRATING TABLE. Charles William Wright, Washington, D. C. (U. S. No. 1,051,049; Jan. 21, 1913.)

MINE-CAR COUPLING. Oscar Anderson and Charles Anderson, Bitumen, Penn. (U. S. No. 1,051,536; Jan. 28, 1913.)

HOISTING—Automatic Trip for Hoisting Skips. Thomas C. Wright, Denver, Colo. (U. S. No. 1,050,898; Jan. 21, 1913.)

MANGANESE STEEL—Method of Making Steel. Henry D. Hibbard, Plainfield, N. J. (U. S. No. 1,051,840; Jan. 28, 1913.)

MINE CARS—Bumper and Coupling for Mine Cars. Chester D. Sensenich, Irwin, Penn. (U. S. No. 1,051,825; Jan. 28, 1913.)

ORE CONCENTRATOR. John S. Hunter, Lamar, Colo., assignor of one-half to John A. Wishard, Lamar, Colo. (U. S. No. 1,051,412; Jan. 28, 1913.)

SETTLING TANK—Receptacle for Separating Solids from Liquids. A. J. Arbuckle, Johannesburg, Transvaal. (U. S. No. 1,051,662; Jan. 28, 1913.)

ROASTING—Improvements in Mechanical Ore-Roasting Furnaces with Vertical Rabble Shafts. J. Parent, Paris, France. (Brit. No. 28,078 of 1911.)

ORE TREATMENT—Method of Treating Finely Divided Ore, Containing Ductile Metal. Thomas J. Lovett, Chicago, Ill. (U. S. No. 13,517, reissue; Jan. 21, 1913.)

CRUSHING—Apparatus for Crushing and Amalgamating Gold or Silver Ores. Walter W. Wright, Pant Ruabon, England. (U. S. No. 1,051,795; Jan. 28, 1913.)

ELECTRIC FURNACES—Improvements in Connection with Electric Furnaces. N. Testrup, London, Eng., and T. Rigby, Dumfries, Scotland. (Brit. No. 19,923 of 1911.)

SAMPLING—Improvements in or Relating to Plant or Apparatus for the Sampling of Ores and for Like Purposes. A. S. Clift, London, Eng. (Brit. No. 21,281 of 1912.)

CYANIDING—Filtering Apparatus. William W. Robacher, Rochester, N. Y., asignor to Just Process Co., Syracuse, N. Y. (U. S. Nos. 1,051,160; and 1,051,161; Jan. 21, 1913.)

IRON FROM SCRAP—Improvements in and Relating to the Manufacture of Iron from Scrap Metal. Sellers Manufacturing Co., Chicago, Ill. (Brit. No. 28,279 of 1911.)

SILICON STEEL—Improvements in the Manufacture of Silicon or other Steel. C. P. Williams, Wrexham, and Brymbo Steel Co., Ltd., Brymbo, Eng. (Brit. No. 1293 of 1912).

PUMPING—Compressed-air Distributing or Regulating Device for Pulsometers and Similar Apparatus. Johann Berning, Düsseldorf, Germany. (U. S. No. 1,051,540; Jan. 28, 1913.)

VANADIUM—Process for Separating Vanadium from Uranium. Warren F. Bleecker, Canonsburg, Penn., assignor to Standard Chemical Co., Pittsburgh, Penn. (U. S. No. 1,050,796; Jan. 21, 1913.)

LEAD-ORE TREATMENT—Process and Equipment for Reducing Lead-Silver-Zinc Ores, Lead Ores Containing Silver and Like Ores. Erich Langguth, Limbourg, Belgium. (Brit. No. 27,411 of 1911.)

FERROSILICON—Process of Effecting Reduction and Producing Ferrosilicon. Eugene A. Byrnes, Washington, D. C., assignor to Electro Metallurgical Co., Chicago, Ill. (U. S. No. 1,051,194; Jan. 21, 1913.)

WASTE HEAT—System for Utilizing Waste Heat from Ore Smelting and Roasting Furnaces for Heating Boilers. Julius W. Hegeler and Herman Hegeler, Danville, Ill. (U. S. No. 1,050,134; Jan. 14, 1913.)

RESCUE APPARATUS—Artifical Breathing Apparatus. Johann Heinrich Dräger, Lübeck, of Germany, assignor to the Firm of Drägerwerk, Heinr. & Bernh. Dräger, Lübeck, Germany. (U. S. No. 1,049,346; Jan. 7, 1913.)

SLAG CEMENT—Apparatus for Producing Cement. Hermann Passow, Hamburg, Germany, assignor, by mesne assignments, to the Atlas Portland Cement Co., New York. (U. S. Nos. 1,051,627, and 1,051,844; Jan. 28, 1913.)

MAGNETIC SEPARATION—Apparatus for Treating Ores in Preparation for Magnetic Separation. James B. Etherington, Winthrop, Mass., assignor to Campbell Magnetic Separating Co. (U. S. No. 1,051,494; Jan. 28, 1913.)

SEPARATION—Machinery for Separating Materials of Different Specific Gravity. Percy John Ogle, London, England, assignor to himself and Mineral Concentrators, Ltd., London, England. (U. S. No. 1,050,991; Jan. 21, 1913.)

EXCAVATING BUCKET. George W. King, Charles B. King, Harvey T. Gracely and Herbert E. Roush, Marion, Ohio, assignors to Marion Steam Shovel Co., Marion, Ohio. (U. S. Nos. 1,050,838, 1,050,839 and 1,050,840; Jan. 21, 1913.)

SEPARATING COPPER from Other Metals by Dissolving Out the Copper and Leaving the Other Metal or Metals Unaffected. Thomas A. Edison, Llewellyn Park, West Orange, N. J. (U. S. Nos. 1,050,629 and 1,050,630; Jan. 14, 1913.)

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—Feb. 1

Governor Johnson has removed A. H. Ward from the board of trustees of the California state mining bureau, presumably because he was not in harmony with the administration. As chairman of the board of trustees, Mr. Ward had criticized the removal of W. H. Storms from the position of state mineralogist and characterized as untrue the report of the state board of control that the bureau was misconducted and the funds misappropriated or unlawfully diverted. John G. Fletcher, of Oakland, has been appointed in Mr. Ward's place. It is hoped that for the good of the bureau this may be the end of the trouble. Mr. Storms, after consulting with attorneys and the mining engineers who recommended him to the position, regarding a contest of the governor's power to summarily remove him, decided that the interests of the bureau and the mining industry of the state would be best served by his refraining from such a course; and has stated that he does not intend to thus hamper the work of his successor. Mr. Hamilton says that he has accepted the position "absolutely without strings," in which case he has a better start for successful conduct of the bureau than had Mr. Storms, whose undoing goes back to his promise to make two appointments asked by the governor. The thing that every man interested in the success of the bureau should now insist upon, is that an adequate appropriation be made by the legislature to enable Mr. Hamilton to carry out the work that Mr. Storms undertook. The new state mineralogist is evidently well equipped for the position, and with sufficient means for performance of the duties that the statute places upon him will, no doubt, give the mining industry the service to which it is entitled. But he cannot do it with the $40,000 which the board of control recommended, and he would only waste his time and injure his reputation in the undertaking. No matter how competent Mr. Hamilton or any other appointee might be to conduct the bureau under fair conditions, he would be wholly unable to carry on, without funds, any work that would be a benefit to the state and a credit to himself. If the politicians and conservationists wish to destroy the mining bureau completely they can do it with the appropriation that has been recommended by the state board of control.

Two bills affecting the mining industry in California have been introduced in the legislature and may prove dangerous. One provides for the creation of a state mining department and the appointment of a mine inspector, who should be ex-officio state mineralogist, thus abolishing the state mining bureau and removing the state mineralogist. The declared purpose of the bill was to provide for the protection of workmen in the mines; but the actual and political purpose was the removal of Mr. Storms, and since he has been otherwise removed, there is now no political or any sane reason for the passage of this bill. That there should be proper provision for mine inspection there is no question, but, as has been contended in this part of the "Journal," such provision should be made through the present efficient mining bureau and the inspection of mines be placed under the direct supervision of the state mineralogist. The law creating the bureau and providing for its operation is good so far as it goes. It should not be repealed, but properly amended.

Restriction of gold dredging is the object of the other bill, which requires dredge operators to obtain a permit from a proposed water commission, in other words, a commission whose chief purpose is, apparently, to conserve all the land in California for the benefit of future generations of farmers. It is useless to recite at length the well known fact that the acreage of land valuable for agriculture that has been, or can be, destroyed by dredging is not worth even the political effort that is being put forth against the mining industry. The gold dredges in California in less than 15 years have produced $50,000,000 of gold, besides producing an immense tonnage of valuable road-building material and material of great value also for railroad ballast and concrete construction; and, moreover, have induced the reclamation of lands for agricultural purposes that would otherwise have remained unreclaimed for as many generations as the comservationsists can hope to provide for. This bill, if enacted into a law, will not only become dangerous, but also vicious in its effects upon the gold-mining industry.

BUTTE—Jan. 29

An Extension of the Clark Fork Line of the Northern Pacific Ry. is planned in order to tap the coal fields at Belfry and Chance, Mont. The route chosen, and upon which it is planned to start construction this spring, parallels the line of the Montana, Wyoming & Southern from Bridger to Belfry, and from there continues on to Chance, which is situated in the southern part of the state close to the Wyoming line. This will be the first railroad to enter the town of Chance and will be a means of exploiting the coal mining industry in that district.

The Cooke City Mining District may sometime have railroad communication, as a corps of surveyors has been engaged for some time in making preliminary surveys for the contemplated building of a railroad in from the Stillwater country. Owing to the position of Cooke City, situated as it is in the most inaccessible part of the mountains with only the hardest kind of a wagon-haul outlet, mining was practically abandoned there years ago, after the richest ore had been mined and packed in sacks on burros to the nearest railroad. With the building of a railroad to the district and the consequent solution of the transportation problem, the camp would undoubtedly be one of the foremost in the state in mining activity.

The Consolidated Oil and Gas Co. of Sheridan, Wyo., and Glendive, Mont., recently opened a pocket of excellent oil in drilling a well in the Riverview Park addition to the city of Glendive, Montant. It has not yet been ascertained whether the strike is of commercial importance.

The Fire in the Stewart Mine of the Anaconda company, which broke out in the stopes between the 1500- and 1700-ft. levels early in December, has been completely extinguished, and it is expected that mining will be resumed in the fire zone within a week or two. Miners are now engaged in taking out the burned timbers, and in timbering up the ground which was caved by the action of the fire and water.

DENVER—Jan. 31

The El Paso Merger is progressing. Announcement is made of a $25,000,000 corporation, incorporated under the laws of Delaware, to be known as the Colorado Mines, Railways & Utilities Corporation. The company will control the El Paso and Golden Cycle mines and the Golden Cycle mill. The new company will be capitalized for 5,000,000 shares with a par value of $5 per share. El Paso stockholders will be offered six shares for five of El Paso stock. The Golden Cycle will be bought for cash by a syndicate that will underwrite the new stock required for its purchase, the price being stated at about $7,000,000. Other property acquisitions may be made later and will probably include the Mary McKinney, but at present only $10,000,000 of stock will be issued. Allan L. Burris, of the El Paso Consolidated, will be the president of the company and Joseph C. Helm, chief counsel. The consulting engineer will be Richard A. Parker, and John H. Nichols will be in charge of operations.

SALT LAKE CITY—Jan. 30

Utah's Metal Production during 1912 for gold, silver, copper, lead and zinc amounted to about $44,000,000, according to preliminary figures issued by the United States Geological Survey. This places Utah third among the western states, and shows an increase of 19% over last year's output. Dividends aggregating $9,500,000 or 21% of the gross output were paid by Utah mining companies. The production of the state exceeded that of Colorado by 20%. Two years ago Colorado's output was the greater. The production of coal is estimated to have increased 15 to 20% over that of last year, notwithstanding some labor shortage caused by the Balkan war. Coke also showed a large increase but production was somewhat held back by lack of coke cars. The proposed electrification and double tracking of the Denver & Rio Grande, together with the projected new coal road to Provo, should give good transportation facilities for the coal district for some time to come.

The Utah Copper Co. produced 5,975,246 lb. of copper in December as compared to 5,802,544 lb. the month preceding. The total production of this company for the year amounted

to 95,105,391 lb. as compared to 99,456,225 lb. in 1911, and 89,127,250 lb. in 1910. The largest month's output was in August, amounting to 11,841,044 lb.; the smallest being that for October, which amounted to 2,128,792 lb., the marked decrease having been caused by the Bingham strike. During November and December, the company increased forces, and gradually recovered from the strike. There is still some labor shortage, and some reduction in output, due to the severe winter weather. The average monthly production throughout the year amounted to 7,925,449 pounds.

NEGAUNEE—Jan. 31

The Crystal Falls District during the last two years has witnessed the discovery of three new deposits which, while as yet undeveloped, according to W. J. Richards, Gen. Supt. for Corrigan, McKinney & Co., contain more ore than has been shipped from the district up to the present time. Regarding the Iron River district, State Geologist Allen has predicted that iron ore will be shipped from there for 100 years at least. On the Nenominee range in general there have been discovered in the past three particularly large bodies of merchantable iron: the famous Chapin mine at Iron Mountain with 30,000,000 tons; the Aragon mine of the Steel Corporation with 10,000,000 tons; and the Caspian mine of Pickands, Mather & Co. in the Iron River district with 10,000,000 tons. It is now stated on good authority that the "Mastodon find" of the Longyear company in the Crystal Falls district ranks up well with these three orebodies. Furthermore the Mastodon find was made in a section of the district that was discredited. Incidentally it was a direct result of applied geology and perseverance.

The Government Rescue Car which is starting work in the Iron River district will probably pursue the following itinerary: Caspian, Bengal, Tully, Baker and Berkshire mines, Feb. 3 to 8; Zimmerman, Baltic, Youngs and Fogarty, Feb. 10 to 15; Davidson, Forbes, Homer, Konwinski, Virgil, James and Purcell, Feb. 17 to 22; Duber, Hiawatha; Chatham, Cortland and Wickwire, Feb. 24 to Mar. 1; Bates, Roger and Chicagon, Mar. 3 to 8. It is planned to have picked groups of men from the different mines attend the lectures which will be given on rescue work. Keen interest in the subject is being shown by the mine superintendents of the district.

SPOKANE—Feb. 1

Litigation Over the Ontario Orebody has been carried on for some time and apparently the first round has been won by the defendant, which is nominally the Ontario mine but in reality the Bunker Hill & Sullivan interests which have control of the Ontario in the form of a working lease. Suit was brought by the Stewart Mining Co., claiming that the defendant was working an orebody which had its apex in Stewart ground. Judge W. W. Woods in the district court decided that such was not the case, upholding the contentions of the defense in regard to the structural geology in dispute. The case, it is said, will be appealed and taken to a higher court.

An Idaho mining organization, for legislative purposes, is contemplated, preliminary details having been completed this week in Boise. Mining companies of the Coeur d'Alenes are being solicited to join. John F. Cook, manager of the Silver City Mining & Milling Co., was named chairman of a committee on permanent organization. A call for a meeting of all mining men in the state has been issued for Wednesday, Feb. 5, in the commercial club rooms, Boise, when permanent organization will be effected. Coeur d'Alene miners have long urged such an organization. Some of the recently proposed legislation would, if enacted into law, result most disastrously to the mining business of the state, it is declared, and is said to be promulgated by men unacquainted with the real needs of the industry. In addition to looking after proposed legislation, the organization will back the proposed state geological survey to aid systematic prospecting. Representatives from the Coeur d'Alenes will attend the meeting in Boise and urge immediate organization upon a working basis.

The Frisco mine is reported bought by the Federal Mining & Smelting Co. for $250,000. The Frisco, which is situated at Gem, Idaho, has been operated since 1889. A contingent contract is attached to the deed, providing for additional payments under certain conditions not made public. Included in the sale is the Frisco mill of 500 tons daily capacity, the water power right on Cañon Creek and all other rights and appurtenances. The holdings of the Frisco Consolidated Co. include 15 separate properties, the Esler, Broad Gauge and Narrow Gauge millsites, Badger, Hardy Fraction, Black Bear, Yankee Doodle, Cape Horn, Idaho Fraction, Apex Fraction, Akron, Grover Cleveland, Gem, Josie, San Francisco and Chief. The Frisco is 600 ft. west of the Morning mine, one of the principal revenue producers of the Federal company, and in the same mineral zone. It is developed to a depth of 2000 ft., and has over 20,000 ft. of underground workings. Originally it was operated as a lead-silver mine, but the increasing percentage of zinc content with depth caused its practical abandonment. The zinc concentrating process recently inaugurated by the Federal company in the Morning mill, at Mullan, seems to have solved the problem of extracting zinc from lead-silver ore and will probably be installed at the Frisco.

TORONTO—Feb. 1

The Elk Lake Branch of the Temiskaming & Northern Ontario Ry. will be formally opened for traffic, Feb. 4. The railway commission will come to Elk Lake on the first train and will be welcomed with appropriate ceremonies by the civic authorities of James township. The opening of the branch is expected to give a great stimulus to mining in the Elk Lake and Gowganda districts, where transportation difficulties have hitherto prevented the shipment of any except high-grade ore. A good deal of ore is being got ready for shipment including two or three cars from the Mann, and a car valued at $75,000 from the Miller Lake-O'Brien.

SUDBURY—Jan. 31

An Investigation of a Number of Fatal Accidents in the mines of the Sudbury district has been made by E. T. Corkill, chief mine inspector for Ontario. The soft weather has been responsible for several accidents. Mike Wazny, a trammer at the Creighton mine, was killed by a large piece of ice falling into the open pit and striking him in the head. Giavanno Busato was killed at the Quartz mine while loading ore buckets in the open pit. A large boulder on the surface became loose as the result of a thaw and fell 40 ft., crushing the Italian. Yalmer Norme, a miner at the Frood Extension mine was working on the 450-ft. level and was killed by a block of wood falling from the surface. The inspector has also preferred charges against two foreigners employed at the Creighton mine for riding to the surface on the skip. A fine of $25 and costs was imposed. The case arose out of the death of a man named Dishno who was killed on Jan. 5 while riding in the skip.

COBALT—Jan. 31

Underground Developments at the Coniagas Mine, says Maj. R. W. Leonard, president of the company, have revealed the fact that the ore supply will not last more than three or four years and that the action of some of the stockholders in trying to inflate the Coniagas stock with a view to unloading should be discouraged. He states that the property is in a satisfactory condition but that the plans show that the property has been pretty thoroughly explored.

Cobalt Power Companies announced, late in January that on account of the shortage of water, a material decrease was to be expected in the amount of power available. A meeting of the Cobalt mine managers was held and they all agreed to curtail their operations sufficiently to reduce their power consumption about 25%. This will affect the production but it is not expected to be of long duration. The open weather and the small amount of snow has resulted in all the swamps and small streams freezing solid, so that the amount of water drained into the lakes and rivers is much less than previous years. When there is a heavy fall of snow, it protects the surface of the swamps and creeks so that the ice is not thick and water flows underneath it.

PORCUPINE—Jan. 31

The Distribution of Hollinger Checks for the fourth dividend, was the occasion for a statement by President Timmins on the strike situation in which he says that the output of the mine is now about 80% of what it was at the outbreak of the strike and if there are no further interruptions, the mill will soon be running at its former capacity. There are now 427 men on the pay roll. From the beginning of the strike on Nov. 15 to Jan. 31, there was milled a total of 13,205 tons, having an average value of $18.80. The detailed figures show, however, that for the last four weeks there has been a considerable increase in the tonnage milled and in the value of the ore. For the week ending Nov. 23, the value per ton milled fell off to $18.25; in the following week to $15.22; and for the week ending December 14, to $12.40; but for the week ending January 21, an average assay of $24.40 was obtained.

Swastika Properties, during the last few weeks, have experienced a considerable revival of interest, due to the success attending the development of the Tough claims. On this property, the vein, while very narrow, is exceedingly rich and several shipments assaying about $400 per ton have been made. As a consequence, work has again been started on several of the adjoining properties.

THE MINING NEWS

ALASKA

BONANZA—A fire at this mine at Kennecott, on Jan. 19, destroyed the loading station of the tramway line, and injured some of the concrete towers. A number of men will be out of employment until the damage is repaired.

ARIZONA

Gila County

ELECTRIC POWER from the Roosevelt dam will probably be brought to Superior, as Government surveyors are at work on a route for a transmission line that will tap the line now being built to Miami at a point near that town. Installation of electric power will act as an impetus to development in this district as the present cost of power is almost prohibitive. The Magma mine is shipping 100 tons of high-grade copper, gold and silver ore weekly and is pushing development work ahead at a rapid rate. The exploration work will be augmented by diamond drilling in about two weeks, one of the drills being already on the ground. The Silver King mine, idle for a decade, was relocated a year ago, and the present owners have sorted some rich silver ore from the dumps and glory hole. The ore is native silver occurring in thin sheets and wire in a light colored, fine-grained porphyry that also carries some tetrahedrite. The Guggenheims are said to have abandoned their option on the Black Diamond property one mile north of the Silver King. Work on the C. & A. property is being pushed and the new shaft is being sunk rapidly. Fifty men are employed.

INSPIRATION—A station is being cut at the main west shaft. Both the main east and west shafts will be concreted. They will have a hoisting capacity of 10,000 tons, each, per 24 hr., and probably a capacity of 7500 tons, each per 16 hr., insuring a full supply for the mill in the event of disablement of one of the shafts. A 20x26-ft. station at Live Oak shaft No. 1 has been finished and a drift started from that point to connect with No. 2 shaft.

MIAMI—At the Miami mine one of the eight diamond-drill holes has revealed ore to a depth of 300 ft. below the 720-ft. level. In the future the main shaft will be sunk to the 870-ft. level to extract the underlying ore. At the Captain shaft No. 1, a large headframe is almost completed and the raise from the 420-ft. level has connected with the shaft at a depth of 200 ft. From that point another compartment is being stripped downward. When completed the shaft will consist of two compartments, one 4x4 ft. and one 3½x4 ft. The larger compartment will be used for hoisting rock extracted during development work, the smaller will be used for counterbalance cages. Fortunately all the development work at the Captain shaft will be in hard rock underlying the secondary enrichment zone. The shaft is being opened to take the place of shaft No. 2, which because of its situation in the orebody will have to be abandoned. The electric hoist now at shaft No. 2 will be moved to the Captain. The 200,000-ton stock pile at shaft No. 2 is nearing exhaustion. Vice-president J. Parke Channing has assumed direct charge of the Miami Copper company during the illness of B. Britton Gottsberger, general manager.

SUPERIOR & BOSTON—A strike of high-grade ore has been made at the Superior & Boston mine, in the raise between the sixth and eighth levels. The ore is copper glance, three feet of which is said to assay 31% copper with drillings into the hanging assaying 16% copper for a distance of four feet. The high-grade ore has thus been proved for a width of seven feet with the hanging wall not yet reached. The raise is now 170 ft. above the eighth level, indicating a continuous orebody between the sixth and eighth levels, and this new strike of glance at the present horizon is considered to leave little doubt that this orebody will extend higher. In the west end of the mine commercial ore was mined to within 30 ft. vertically, of the surface in this same vein.

SOUTH LIVE OAK—Unusually rapid progress is being made at churn drill hole No. 6. The drill has already attained the depth of 600 ft., an average of 30 ft. daily having been maintained since the starting of the hole 20 days ago. The management report that the drill is now passing through a zone of schist heavily stained with iron which is a favorable indication of ore in depth. This hole is 350 ft. southwest of hole No. 5 and as 90 ft. of 2¼% ore was reported as encountered in No. 5 at a depth of about 800 ft., it is expected, at No. 6, to strike ore at a similar depth.

Greenlee County

SHANNON COPPER CO.—During the four months ended Dec. 31, 1912, there was mined, according to the company report, 95,235 tons of ore producing 5,149,805 lb. of copper, 1012 oz. of gold and 54,394 oz. of silver. The costs were about 13½c. per ton. The costs were unusually high because of having charged against the four months' production certain increases in taxes and liability insurance, the result of legislative enactments, which should have been distributed over the entire year. The total net profit from the four months' operations was $208,871. About $40,000 was expended on exploration work with favorable results in the Shannon and the outside mines. Good ore was encountered in the west and sub-levels of the Shannon. The company is gradually buying up Shannon-Arizona Ry. bonds so as to retire them before they become due in 1919 without using the stock authorized for conversion. A new store and warehouse, 75x75 ft., of brick and concrete has been completed in the center of the townsite near the smelting works.

CALIFORNIA

Amador County

CENTRAL EUREKA—Underground work is temporarily suspended owing to the closing of the shaft of the South Eureka adjoining on the south. The two mines are connected by drift at one of the lower levels, and each thus secures ventilation and a second outlet. Besides this, the two mines have been pumped by the same electric pump which is in the South Eureka shaft. Since the shaft is closed the pump is out of commission. The work of clearing the South Eureka shaft is still in progress, but the second caving hampered the progress.

LINCOLN CONSOLIDATED—Since the flooding of the 1950-ft. level by water from the Wildman, the cars, drills and other tools have been removed and work suspended until arrangements may be made for a larger pump, and a decision reached as to the best and most economical plan for unwatering the mine and for checking or turning the flow from the Wildman. Development may be resumed through the Emerson shaft instead of the Lincoln.

Butte County

WADE DREDGE—A permit has been obtained from the county supervisors to dredge a quarter-mile section of the Centerville road adjoining ground on which the dredge is operating on Butte Creek, 10 miles from Chico. The permit requires the construction of a new section of road and the replacement of the dredged section of road after the ground has been dredged. John Ross Wade is manager.

BUTTE CREEK CONSOLIDATED—The remodeling of this dredge on Butte Creek, 10 miles from Chico, is completed to the point where the hanging of the bucket line begins. The buckets have been received. They are of the 5-cu.ft. close-connected Bucyrus type, made of manganese steel. The old buckets were 11 cu.ft. and were in operation for three years. H. P. Galligan, of Chico is superintendent.

Del Norte County

ORO DEL NORTE—This company has resumed the work of installing a plant for saving gold and platinum near Crescent City. Mr. Strohm is manager.

Humboldt County

ORO WATER LIGHT & POWER—A large acreage is reported to have been bonded by this company near the Siskiyou County line for the purpose of installing a gold dredge. The land has been worked for a number of years with giants by the Orleans Mining and Development Co. There is still virgin ground in the holding, which the present operating company has prospected with Keystone drills. This company has operated successfully at Oroville for a number of years and is also operating a dredge in Calaveras County.

Inyo County

SKIDOO MINES CO.—The cyanide plant of this company was closed down for the winter on Dec. 15. During the month $12,287 worth of bullion was produced on which a profit of $7497 was realized.

Kern County

KING SOLOMON—High-grade ore was disclosed in the new raise 75 ft. above the 250-ft. level. There are 35 tons of ore in the bins and milling will begin in February.

WINDY—The last milling of 30 tons from the P. Fahey lease made at the Red Dog mill returned $2000.

COLORADO

Clear Creek and Gilpin Counties

LAMARTINE—This property is to be reopened and developed by a recently organized company of local operators. Geo. K. Kimball is manager.

POORMAN—A vein of silver ore is said to have been struck in this Freeland property, assaying 500 oz. silver and 1 oz. gold.

BLUE RIDGE—Development of this property at Dumont has been successful and the mine is reaching the producing stage. R. V. Stanhope is manager.

POZO—A new shaft house is under construction. As soon as the building is ready a 75-hp. electric hoist will be installed. The shaft is now 265 ft. deep and will be sunk to the Newhouse tunnel. The vein is four to six feet wide.

TOBIN MINE—One of the richest strikes made in years in the East Argentine district is reported from the Tobin mine which is undergoing development by J. B. Knaube and associates of Denver. The ore is said to be a tellaride of silver with a rich streak varying in width from four to seven inches and showing $300 a ton in gold and silver. The discovery was made on the Wheeling vein by Johnson & Co., who have a sublease. Stoping has been started and it is hoped to begin shipments soon.

Lake County—Leadville

AMIE—During the week the lessees on the Amie Fryer hill opened a streak of lead in one of the lower levels, said to carry 50 oz. of silver and about 20% lead to the ton. The vein is being developed. In this property the lessees have had a good body of iron and another of siliceous flint, which are available ore.

RELIANCE GOLD DREDGING CO.—The dredge continues in steady operation during the winter as well as the summer.

SOUTH EVANS—Outside of the work being carried on at the Cleveland and Valley shafts, the Silent Friend is shipping steadily a good tonnage of medium-grade ore. It is announced that the Ollie Reed shaft No. 2 will resume operations. The lease on the property has been granted to H. C. Watson and Otto Thurn, and the work of repairing the surface plant is now in progress. An electric hoist will be installed.

LITTLE GIANT—The output from the Little Giant, on Carbonate Hill, remains about the same. Most of the work is being done in the iron stopes to the east and west of the shaft; the best ore coming from the west side.

NEW MONARCH—Now that connections have been made with the Katy and New Monarch shafts, on Little Ella Hill, Manager Watson will install an electric hoist at the latter shaft.

San Juan Region

NEWMIRE—The electric power line from the Ilium plant to the reduction plant of the Newmire vanadium works is progressing slowly, on account of material not being available at the proper time. The pole holes have been dug.

LIBERTY BELL—Automatic stokers are now used in the mill, resulting in some economy in that department.

TOMBOY—The Tomboy tramway is nearing completion. It has been held up by lack of lumber and other materials and by intense cold weather with bad snow storms and blizzards. A carload of tables for the mill has been received and a carload of transformers, etc., for the electrical equipment.

CAMP BIRD—The net profits for December are estimated at £26,977. This is from all holdings.

WANAKAH MINING CO.—This company, of Ouray, crushed 4469 tons during the quarter ended Oct. 31, 1912. A total income of $48,232 was obtained and expenses of $24,001 were incurred, leaving an operating profit of $24,230. Development work to the extent of 707 ft. was done.

IDAHO

Shoshone County

AMAZON—The new camp is established and as soon as supplies are in a large force will be put at work in the mine.

IDORA HILL—In spite of the recent heavy fall of snow work on the excavations for the concentrator have been uninterrupted.

ILLINOIS

THE ROSICLARE AND FAIRVIEW FLUORSPAR MINES were seriously flooded in the middle of January by the high waters of the Ohio River. According to the latest reports they are still under water.

MICHIGAN

Copper

NEW BALTIC—Operations are centered in driving a crosscut from the 500-ft. level across the entire tract. A distance of about 1350 ft. has been covered, leaving about 2500 ft. more to go. This work will open the various formations that are believed to extend across the territory and results are being watched with interest.

INDIANA—The shaft at this property is down about 1275 ft. and with the next hundred feet of sinking should reach the formation which yielded the remarkable drill core about two years ago.

LAKE COPPER—This property is shipping about 350 tons of rock to the mill daily, about equal amounts being taken from the stock pile and from the underground openings. The rock coming from underground is averaging about 25 lb. of copper per ton.

WYANDOT—The winze on the No. 8 lode is down about 85 ft. with continued good results. This winze will go to a depth of 125 ft. and drifting will be started. Should the formation continue it will be opened by a new shaft, as the present No. 11 shaft is but an exploratory affair and is too far away from the lode.

CALUMET & HECLA—Operations on the Osceola amygdaloid lode are being pushed vigorously. No. 14 shaft is being fitted with a new hoisting equipment and the rock house is being remodeled to accommodate enlarged crushers. At No. 15 shaft the two compartments are working satisfactorily, using 7½-ton skips. At this branch of the property one-man drills are being introduced as fast as they can consistently.

LA SALLE—The work of reconstructing the two-shaft houses at the sites of No. 1 and No. 2 shafts is going forward satisfactorily and operations can be resumed in the early spring. This property is extensively opened by No. 1 shaft and as soon as the equipment is ready, shipments can be maintained.

Iron

SALISBURY—A 250-hp. electric motor has been transferred to this mine of the Cleveland-Cliffs Iron Co. from the Smith or Gwinn mine. The motor will be used for running an air compressor, soon to be installed. Electric pumps and an electric hoist were recently put in; the company is completing the electrification of all its mines in the Marquette and Gwinn districts.

CLEVELAND-CLIFFS IRON CO.—At the contest of first-aid mine teams held in Ishpeming under the auspices of the Y. M. C. A., five mines of the Cleveland-Cliffs Iron Co. were represented. The Lake Mine team won the contest, and the Negaunee Mine and North Lake mine teams were given honorable mention. Each team consisted of five men.

JONES & LAUGHLIN ORE CO.—At the new Forbes mine in the Iron River district, contractor Wahlman of Ishpeming is building a new change house for the Jones & Laughlin Ore Co. The building is 35x75 ft., is of red brick with concrete floors, and will accommodate 125 men with room for extra lockers if desirable later. The change house is just west of the new engine house recently completed.

PICKANDS, MATHER & CO.—Twenty-five representatives of this company from its Lake Superior iron mines recently met in Chicago for a discussion of business principally regarding the installation of safety appliances.

CHICAGON—At this mine of the Rogers-Brown interests in the Iron River district a Webster, Camp & Lane geared hoist was recently received from the company's Mesabi range property. The hoist has been installed in an addition built on the engine house.

FLORENCE IRON CO.—At this company's Florence mine at Florence, Wis., engine house No. 1 was totally destroyed by fire on Jan. 17. The loss is estimated at $12,000, fully covered by insurance; the fire caught from sparks blown by a high wind from burning waste which was being used to thaw frozen pipes.

MINNESOTA

Mesabi Range

PITTSBURGH IRON ORE CO.—This company will equip its mines at Mountain Iron with electric driven machinery, the installation calling for 12 General Electric motors of from 15 to 50 hp.

LONGYEAR—At this mine Butler Bros., contractors, are cutting an approach, which will be deeper, however, when permanent, and it is expected that this work will be completed about the middle of February.

MISSOURI

GRANBY MINING & SMELTING CO.—This company has proved the richness of its drill strikes on the Chitwood tract by extending one of the drifts of the old B. & H. shaft. As the drift approached the drill hole a seam of ore was encountered which gradually widened out until a 25-ft. face was developed. Both jack and galena are found with jack predominating, the ground will be more thoroughly developed before a mill is built.

MONTANA

Butte District

CORBIN COPPER CO.—This company which is operating properties in Corbin, Jefferson county, and in the Rochester district, Madison county, has secured an option to purchase a group of three claims in the Butte district, the price being $150,000. The claims, consisting of the Gambrinus, a full-size claim, and the Belcher and Walsh fractions, are situated about 800 ft. west of the Gagnon shaft of the Anaconda company, and are believed to contain the western extension of the Anaconda-Parrot vein. For the purpose of financing this latest acquisition, the directors have levied an assessment of one dollar a share on the stock of the company and it is proposed to begin work at once in sinking a vertical shaft to develop the property.

DAVIS-DALY—For the future success of mining operations at the Davis-Daly property, much is dependent upon the finding of ore in the western portion of the territory. The crosscut being driven south on the 1900-ft. level from the Gagnon shaft of the Anaconda Co. to develop this section, has now gone 1025 ft. and is expected to intersect the Silver King vein within another month, depending upon the dip of the vein. Since the opening of the 1900-ft. level of the Colorado shaft some months ago, 2100 ft. of crosscutting and drifting has been done, and two veins, No. 1 and No. 12, opened quite extensively. No. 1 vein, which is at present being drifted upon, varies in width from 10 to 20 ft., but so far has shown very little ore of commercial grade. No. 12 vein, as far as developed, averages about four feet in width but carries higher grade ore than No. 1.

OPHIR—The new mill at this property of the Butte-Central Copper Co., is nearing completion and the management expects to begin operations by the middle of February. The ore bins are now being filled with ore from the mine for the preliminary run.

ANACONDA—An increased saving is expected after certain contemplated changes are made in the Washoe plant. Tests conducted first at Great Falls were later followed by remodeling a whole section both there and at the Washoe, and so much success was obtained with these units as to warrant changing over the entire Washoe plant. This work will be done one section at a time and will not be completed until some time next year. It has been stated that the new method, which consists of a more perfect classification, will not only insure a saving better than 80% but will also afford greater capacity.

Cascade County

FLORENCE—A strike was recently made on the 500-ft. level of this silver-lead property near Neihart which gives it a new lease of life. Prior to 1904 the mine paid over $300,000 in dividends; the vein however, which has a general north and south strike, is displaced by a fault and only the portion north of the fault was mined, search for the continuation of the vein south of the fault having proved unavailing. Under a new management the search was continued a few months ago, and after drifting about 40 ft. along the fault the vein was discovered and drifted upon, and found to be fully as rich as the mined portion. Regular shipments of ore from the stopes between the 500- and 400-ft. levels, are being made.

Missoula County

TRIANGLE MINING & DEVELOPMENT CO.—This company of Missoula, has issued a call for its stockholders to meet Jan. 30, to vote $150,000 in bonds to raise funds for building a concentrator.

NEVADA

Clark County

THE NEW CAMP OF SILVER BASIN is sending out encouraging reports; it is situated near St. Thomas in the Muddy Valley. Rich silver ore is being mined and will be shipped as soon as roads are in condition for hauling. The geology of the camp greatly resembles that of Silver Reef, Utah, not far distant from the new strike, the ore occurring in veins and lenses in sandstone. J. M. Thomas and Anderson brothers are among those interested in the camp. It is also reported that gold ore is being mined within a few miles of the camp.

YELLOW PINE—The annual stockholders meeting was held at Goodsprings on Jan. 18 and the old board of directors re-elected. The annual report shows that during 1912, 19,463.5 tons of ore were milled and 518.7 tons shipped as crude zinc ore. The mill ore averaged 15.5% lead, 30.2% zinc and 10.8 oz. silver. Net smelter returns for the year aggregate $371,975.67, and the net profit on operation was $228,135.24. Of this, $123,000 was distributed as dividends during the year. A dividend of two cents per share was declared payable Jan. 25, and it is the intention to pay this amount monthly throughout the present year. In addition to the ore reserves in the main vein, a body of carbonate ore is being opened north of the shaft, and distinctly separate from the main orebody. Seventy men are now employed on the property.

Comstock Lode

COMSTOCK PUMPING ASSOCIATION—Whitman Symmes was deposed as superintendent at a recent meeting of the association and A. M. Walsh appointed as his successor.

GOLD HILL—The annual meetings of the Crown Point, Belcher and Yellow Jacket companies were recently held in San Francisco and George S. Sturges, was re-elected general manager and superintendent. The annual report of the manager showed the properties to be in good physical condition. During the year 29,447 tons of low-grade ore were treated at the Yellow Jacket mill and the gross value of the product was $144,549. It is expected that operations will be enlarged, pumps installed and ground 200 ft. in depth recovered. Few assessments were levied during the year, one of $0.10 being the largest.

SIERRA NEVADA—An ore chute is being built at the bottom of the raise in the ore on the 2500-ft. level. The north drift on this level is in vein matter, carrying considerable quartz of low assay.

Esmeralda County

GOLDFIELD CONSOLIDATED—A report to the stockholders for the fourth calendar quarter of 1912 shows that 86,294 tons were treated and a recovery of $1,255,782.05 obtained at a cost of $510,248.19, leaving net operating realizations of $745,533.86.

Humboldt County

A DISCOVERY OF OPAL is reported from the northern part of the county near Virgin Creek, southeast of Denio, Oregon.

ROCHESTER—This new camp is situated about 10½ miles east of Oreana, a station on the Central Pacific Ry. and at the head of American Cañon in the so called Humboldt Range. There are said to be about 10 companies operating and excitement is apparently increasing.

White Pine County

NEVADA CONSOLIDATED—Coal for the steam shovels has been received. Drilling is being prosecuted on the Butte & Ely and the New Ely Central ground.

BOSTON & ELY—A pump purchased from the Giroux will be installed to handle an excessive flow of water in a drift on the 1200-ft. level.

GIROUX—An improved method of handling ore from the Morris shaft is in use. The cars which were formerly trammed on the surface to the chutes for the railroad cars are now hoisted and dumped into the skip bins. This makes it possible to screen out the coarse material with grizzlies. This coarse rock which needs crushing is about 10% of the whole and, as the contract with the Steptoe smelter calls for a difference in price on coarse and fine ore, a material saving is effected. The company is buying its mine timber already cut and framed. It is cut near the head of Duck Creek, hauled to the mill in McGill by wagons or sleighs and there cut by machinery, electric power being supplied by the plant of the smelting company. Lagging is bought in carload lots cut to length, ready for use. About a carload of timber is used per day.

SMOKY DEVELOPMENT—The manager of this company, Mr. Williams, has returned from Boston and states that capital has been obtained to push development. A compressor and drills will be purchased and the tunnel driven to the lime contact about 1000 ft. ahead. The tunnel is said to have been in ore for 200 or 300 ft. and it is hoped that this will continue and improve at the contact.

McDONALD-ELY—This company is sinking a winze in the old workings. A vein of good width carrying copper, gold and silver is reported.

NEW MEXICO

Grant County

MANGAS COPPER CO.—It is said that this company will begin development work again on its Burro Mountain claims.

SAPOLLO—J. W. Bible is managing this property about 20 miles from Hanover and is said to be shipping two car loads of meerschaum per month to New York.

Socorro County

MAUD MINING CO.—Preparations are under way for active resumption of work on this property.

ERNESTINE MINING CO.—A De La Vergne twin oil engine of 250 hp. capacity has been ordered and grading for the foundations is now going on. When installed, the company will have a rating of 520 hp., ample for all present purposes.

THE OAKS COMPANY—Active development continues on both the Pacific and Tunnel groups, good ore being encountered in tunnel A on the latter. Regular shipments are being made to the custom mills.

DEADWOOD MINES—Work on the 500-ft. level, the lowest in the mine, is proving highly satisfactory. Four bars of bullion were shipped during the week and the tables yielded 18 sacks of high-grade concentrate. Ore to the amount of 250 tons was handled and 25 ft. of development was done.

OREGON

Clackamas County

OGLE MOUNTAIN MINES—This property shows development work of 4700 ft. and has attained a depth of 1000 ft. It is planned to erect a 100-ton cyanide plant in the spring. Charles F. Spaulding, of Denver, will be superintendent of both the mine and the cyanide plant. J. B. Fairdough of Oregon City, Ore. is the manager.

Jackson County

STERLING—S. S. Bullis and his son, R. S. Bullis, of New York have secured possession of the old Sterling placer mine lying about 12 miles southwest of Medford. They contemplate constructing a high-line ditch to render a large part of the property suitable for hydraulicking and will begin operations the first of March. R. S. Bullis will be in charge.

Josephine County

ORIOLE—A ten-stamp mill for this mine situated near the post office of Galice will be installed early in this season, according to J. C. Mattison, manager of the property. The new equipment ordered will amount to 125 tons. The Oriole has been a shipper for the last five years, sending its ore to the Tacoma smelter. It is claimed that a considerable amount of $9 to $10 ore is blocked out in the mine which can be profitably handled in the new mill. Underground development amounts to about one mile. Ore is now being taken from the 600-ft. level.

VANGUARD—C. E. Phillips, manager, states that gold and copper ore has been encountered.

LELAND CONSOLIDATED MINING COMPANY—This company is a placer consolidation recently organized by John C. Lewis, H. K. Miller and others. Active work is under way and 10 giants are working day and night. Much attention will be given to the saving of the fine gold and platinum values which have heretofore been wasted.

UTAH

Juab County

TINTIC SHIPMENTS for the week ended Jan. 24 amounted to 164 cars. There is still a shortage of cars, and the cold weather has restricted shipments to some extent.

OPOHONGO—Four cars were shipped during the week ended Jan. 24. Drifting to the east on the 300-ft. level will be soon started.

IRON BLOSSOM—The new electrical equipment at the No. 1 workings has been placed in commission. The Iron Blossom is the eighth Tintic property to electrify its plant. The motor is coupled directly to the main shaft of the hoisting engine, eliminating intermediate gears. Direct current frpom a motor-generator set is used. There is a complete measuring and recording apparatus, so that a record of efficiency can be obtained. Work suspended below the 800-ft. level of the No. 1 workings for some time will be resumed, and prospecting at depth carried on in this part of the mine.

YANKEE—At the annual stockholders' meeting held Jan. 27 a dividend of 1c. a share was declared, payable Feb. 1. During 1912, ore shipments amounted to 22,811,420 lb., including 2,179,760 lb. shipped by lessees, 17,434,660 lb. of dump ore, and 3,197,000 lb. of zinc ore. The total brought net returns of $50,773. Net returns from all sources, including $20,000 from assessment No. 7 were $72,542, and operating expenses $52,637, leaving a balance on hand Jan. 1, 1913 of $19,905. A mineralized zone has been opened from the 1700- to the 2000-ft. level, and ore is looked for at any time. So far, the zinc orebodies have been opened over an area of 1000 ft. across the property, and shipments of ore of this character are being made as fast as cars can be obtained.

Salt Lake County

OHIO COPPER—Operating profits for December are given as $20,000. About 2000 tons daily are being treated with two sections of the mill in operation. The third section is expected to be ready for operation some time during February.

COLUMBUS CONSOLIDATED—A meeting has been called for Jan. 30 to consider the proposed merger with the Columbus Extension and other companies at Alta. It is planned to form a new company with a capitalization of a million shares. Of this, 160,000 shares are to be exchanged for the Consolidated stock, 100,000 shares for the stock of the Columbus Extension, and 140,000 shares for stock in other companies. This will leave 600,000 shares of stock unissued in the treasury.

Tooele County

GALENA KING—This property is shipping a car a week. When the installation of machinery, now in progress, has been completed more extensive development will be undertaken. The work is under the direction of Duncan MacVichie.

MARSHALL—Walker & Morrell, lessees on this property, have recently made a shipment.

Utah County

SANTAQUIN CHIEF—Streaks of ore that were followed have enlarged, and the entire face is at present in ore.

SANTAQUIN KING—Ore is being accumulated for a shipment, which will be made soon.

VIRGINIA

CRIMORA—This manganese deposit has recently been taken under option by a New York and Chicago syndicate and arrangements to finance a plan for its extensive operation are in the forming. It is proposed to fill the open pit of the old workings with water and to extract the manganese-bearing clay by means of a dredge. Engineers' reports indicate that there is over a million tons of manganese ore in the clay deposit controlled by the company. The average grade of the clay is reported to be 6% of manganese ore. The mine was worked by the Carnegie company for several years.

WASHINGTON

Ferry County

FIRST THOUGHT—This company is considering the installation of an oil-burning smeltery for the treatment of their ores. P. Burns has charge of the work.

A SYNDICATE is being planned by the Western Water Power Co. to take over the more important mines in the Republic district and construct a concentrating plant large enough to treat the entire ore output.

Spokane County

H. E. M.—This company has increased its capitalization and will use the additional money to further develop its property.

WISCONSIN

Platteville District

FEDERAL—This mine, south of Hazel Green, has been taken over by the Wisconsin Zinc Co.

GLEN RIDGE—A small milling plant has been completed at this mine, formerly the Pilot Knob, three miles south of Galena.

HODGE—Mining operations have been resumed by the Wisconsin Separating Co.; the Kohinoor milling plant has been moved and reassembled.

LAFEVRE RIVER—Control of this property has passed into the hands of August C. Kurz, of Milwaukee, Wis., who will continue development.

NEW ENTERPRISE—This company struck jack while drilling on the Kruse lot within the city limits of Platteville.

CANADA

British Columbia

BRITISH COLUMBIA COPPER CO.—The Queen Victoria mine, near Nelson, which was purchased by this company from John P. Swedborg recently, has just sent 580 tons to the smeltery at Greenwood. It is stated that between 40,000 and 50,000 tons of low-grade copper ore are blocked out at the mine, which is connected to the railway by a tramway.

GOLDEN ERA MINES—Samples of gold-bearing ore from this mine at Kitselas are being exhibited.

CONSOLIDATED MINING & SMELTING CO.—The tramway connecting the No. 1 mine of this company with the lake in Ainsworth district has been completed. The tramway, which is about 7000 ft. long, will use the same terminal as the tramway between the Highland mine and the concentrator. Ore from the Silver Horde mine will have an outlet by way of the same tramway.

LILY B. MINE—A carload of high-grade silver-lead ore, it is said, was sacked at this mine, near Slocan City, in January. Most of the ore comes from a body opened in the course of sinking and drifting on the 200-ft. level, but some will be got from the shoot opened recently in raising.

Ontario-Cobalt

POWERFUL—A strike of silver ore has been made on the 150-ft. level of this Gowganda property.

BELLELLEN—This property is to be reopened.

CHAMBERS-FERLAND—Arrangements are being concluded for the sale of the stock of this company to the Cobalt Aladdin, the English company which is now operating the Silver Queen. The price is understood to be 40c. per share.

WETTLAUFER—At the annual meeting, an amicable agreement was reached between the insurgents and the old directors. The annual report showed net profits for the year, $320,249, an increase of $6859 over the preceeding year. The surplus after dividends was $36,931, a decrease of $63,931. The quarterly dividend which calls for $75,000, is due on April 20, and it is believed this will have to be dropped.

COBALT FINANCE TRUST CO.—This company has been formed by English capital to operate properties near the Casey-Cobalt.

CITY OF COBALT—The financial statement for the 15 months ended December, 1912, shows total revenues of $155,265, while the total expenditures amounted to $167,919. A special meeting has been called for Feb. 5 to consider three by-laws, one to authorize increased capitalization, one to authorize the directors to borrow $100,000 with which to build a concentrator and a third to authorize the directors to dispose of the property. The board of directors is divided in these matters and a stormy meeting is expected.

MILLER LAKE-O'BRIEN—This company has purchased the Millerett property and is utilizing the 10-stamp concentrating mill for its low-grade ores.

SENECA-SUPERIOR—An explosion of dynamite occurred in the thaw house but the damage was slight.

TOUGH—Twenty tons of gold ore, assaying about $400 to the ton, have been shipped from this Swastika property.

GOLD LEAF—This is a new company formed to operate the Boissoneault-Charlebois claims near Kirkland Lake in the Swastika area. It is said that $250,000 was paid for the property.

LUCKY CROSS—At the annual meeting held in Toronto, Jan. 28, the secretary-treasurer's report showed that about $100,000 had been expended in development and that the company was free of debt. The stamp-mill is being pushed to completion and is expected to be in operation in March. About 500,000 shares of the stock remain in the treasury.

DOME LAKE—A 30-in. vein, carrying $30 ore has been cut at the 180-ft. level. The capital is to be reduced from $2,500,000 to $500,000.

DOME—The normal production is being maintained and the company now has all the men necessary. The new pumping station to Porcupine Lake has been completed as far as Porcupine River and a plentiful supply of water is assured.

NORTH DOME—The annual statement of this company shows receipts of $104,103 and expenditures, $103,366.

MEXICO

THE MONTEREY, MATEHUALA AND VELARDENA SMELTERIES of the American Smelters Securities Co. were compelled to close recently, owing to transportation interruptions, and the Chihuahua smeltery was also experiencing an acute fuel and ore shortage. Word has been received that the Monterey plant has resumed operation.

Guanajuato

PROVIDENCIA MINING & MILLING—This company reports a production in 1912 of 627,379 pesos from 55,852 dry tons of ore milled. The total profits for the year were 105,517.20 pesos. During the year a total of 16,193 pesos was spent on new construction at the mill, and 5,909 pesos on other new work. The ore reserves at the end of the year were estimated at 57,000 tons.

MINERAL DEVELOPMENT—The crosscut on the 600-m. level of the Neuva Luz property, which is expected to reach the mother lode of the Guanajuato district within the next 700 ft., has cut a vein of sulphide ore, 2½ ft. wide, said to assay 100 grams of silver and 2 grams of gold per ton. The cutting of the vein is regarded as important, inasmuch as it proves the existence of gold and silver at that depth, 1966 feet.

Guerrero

ESPIRITU SANTO—This Taxco property is under option to the Exploration Co., of England and Mexico, a subsidiary of the Exploration Co., Ltd., of London, at a price said to exceed 1,000,000 pesos. An examination is in progress. The property is owned by A. J. Hunter and associates. The proved tonnage is said to be large.

San Luis Potosi

EL BARRENO—The results from direct cyanidation were not satisfactory, and enough Wilfley and Deister tables for a five-stamp battery are being put in. If these solve the treatment problem sufficient tables for the 20 stamps will be installed. The company is shipping some ore to the San Luis Potosi smeltery.

Sonora

LUCKY TIGER-COMBINATION—Production for December was $143,877 and expenses, $84,988, leaving a profit of $58,889. There was crushed 6621 tons of ore.

EL TEMBLOR—At this property about 15 miles east of El Tigre, an excellent strike of ore is said to have been made.

MINNEAPOLIS COPPER CO.—This company at Cumpas is at present constructing its new smelter, and when it is blown in, about the middle of January, operations will be kept up to such a point that the company will produce 15,000,000 lb. of copper annually.

TRANSVAAL—Work has been resumed on this property, previously shut down on account of rebel activity, and shipments are being made to the Douglas smeltery. H. C. Beauchamp is the manager.

Zacatecas

VETA GRANDE—This old property, one of the most extensive in the Zacatecas district, has been taken over by the A. Goerz interests of London, now controlling the La Fe y Anexas Co. A payment of 10,000 pesos has been made, and another payment will be made before the end of the year. The mine has been developed by a shaft to a depth of over 1000 ft., and the old workings are extensive. There is a big dump on the property. The Goerz interests are building a 30-stamp mill, concentrating and cyaniding plant, and are carrying on extensive pumping and development operations at the La Fe y Anexas.

LA NORIA—The option on this property given to the Esperanza company has not been exercised and the mine is now again in control of the owners, G. C. Palmer, of Zacatecas, and Leon O. Bailey, of New York. An examination of the property and of other adjoining property owned by Robert S. Towne, of New York, was made for the prospective buyers by Denny brothers, of Mexico City and London. The extension of the Mexican National Ry. from Gutierrez on the main line north of Zacatecas is now in operation beyond La Noria, and has reduced the distance to the railroad from 70 miles to 11 miles. La Noria is shipping regularly, and has greatly increased its reserves of low-grade ore during the year. Mr. Palmer is in charge.

AFRICA

Rhodesia

GOLD PRODUCTION reported in December was 51,716 oz., being 1951 oz. less than in November. For the year ended Dec. 31, the total output was 628,521 oz. in 1911, and 641,806 oz.—or $13,266,130—in 1912; an increase of 13,285 oz. for the year. Other metals and minerals reported for 1912, included 176,542 oz. silver, a decrease of 11,099 oz.; 595 tons lead, a decrease of 44 tons; 69,260 tons chrome ore, an increase of 16,894 tons; 216,040 tons coal, an increase of 3517 tons.

ASIA

Chosen

ORIENTAL CONSOLIDATED—The gross receipts for October, 1912, were $121,837, of which $32,320 remained as net profit. For November, the gross receipts were $136,460 and the net profits $47,222. Cable advices give $139,000 for the January cleanup.

THE MARKET REPORT

METAL MARKETS

NEW YORK—Feb. 5

The metal markets generally have been rather inclined to quiet. The copper market is still in rather a disturbed and unsettled condition, with a tendency to lower prices.

Exports of gold from New York, week ended Feb. 1, were $3,510,000, chiefly to Argentina and Brazil; of silver, $1,155,945, principally to London. Imports of gold were $353,936; of silver, $418,280, mostly from Mexico and South America.

Gold in the United States, Feb. 1, as estimated by the Treasury Department: Held by Treasury against gold certificates, £1,086,351,169; in Treasury current balances, $172,221,111; in bank and circulation $617,$53,838; total, $1,875,626,118, which is a decrease of $2,951,004 during January.

Coined Silver in the United States, Feb. 1, as estimated by the Treasury Department: Standard dollars, $565,505,020; subsidiary coins, $174,667,638; total, $740,172,658. Of the dollars $478,209,000 are held against silver certificates outstanding.

Gold, Silver and Platinum

Gold—Prices on the open market in London were unchanged at 77s. 9d. per oz. for bars, and 76s. 4d. per oz. for American coin. In New York an additional $1,500,000 in gold was taken for export to Brazil, on European account, and $1,000,000 for shipment to Paris.

Iridium—Supplies are extremely scarce and prices have advanced to $83 per oz., New York.

Platinum—The market is a little more active here, and is reported firm abroad. Dealers here ask $45@46 per oz. for refined platinum, according to size of order; for hard metal $49@51 per oz. is asked, according to grade.

Silver—Owing to delays in the Chinese loan negotiations, silver declined to 28½d., but confidence was expressed on Tuesday that the proper signatures to the contract would be immediately given. This assurance was a fillip to silver, which advanced to 28⅞d., only to be followed again today by a ⅛d. decline, owing to the hesitation of the French Foreign Office to subscribe to the conditions. It is thought, however, the hitch in the negotiations will be soon overcome and this should have a favorable influence on the silver market.

Exports of Silver from London to the East Jan. 1 to Jan. 23, reported by Messrs. Pixley & Abell:

	1912	1913	Changes	
India	£727,300	£871,500	I.	£144,200
China	110,000	10,000	D.	100,000
Total	£837,300	£881,500	I.	£ 44,200

Shipments of gold to India were £224,000 for the week.

Copper, Tin, Lead and Zinc

Copper—The unsettled conditions prevailing during the week of our last report have continued without material change, but the aggregate of sales this week has been much less than last. There is apparently a big buying power among the domestic consumers, and among the European also, which will develop when sellers generally are willing to make a market or when buyers are starved into doing so; but at the moment buyers do not know what to do. Many of the agencies and other sellers have disposed of all their copper available for February delivery and are seeking to make contracts for March and later deliveries, and offering such at receding prices. The United Metals Selling Co. and the American Smelting & Refining Co. are supposed to be the only ones having large quantities of February copper available, and they are waiting for buyers who are short to come to them and pay their price asked. The price asked varies from 16½@16¼c., delivered in Europe or America, usual terms.

In view of the unsettled conditions prevailing during the week it is difficult to quote the average of the market. Outside electrolytic copper for prompt delivery has been offered and sold at 16c., cash, New York; and copper for March delivery has been offered and sold on terms corresponding to 15.60c., cash, New York. Lake copper has been available at about 16c. but on Monday 16½c. was paid for a special brand on an order for several hundred thousand pounds. This is illustrative of the present condition; the buyer requiring a special kind of copper or a special delivery has to pay what is demanded by the producer to whom he must go; while the buyer who is simply providing for his general requirements may obtain coper at sharp concessions. On Feb. 5 electrolytic copper for February delivery was reported sold by dealers in Europe at 16c., in meeting which price sellers from here would realize only about 15¾c. A surprising feature of the last fortnight has been the large quantity of electrolytic copper seriously offered in this market by dealers, and there has been considerable speculation as to whence this copper has been coming.

At the close we quote Lake copper at 15⅞@16⅛c.; electrolytic in cakes, ingots and wirebars at 15.60@16c. Casting copper is quoted nominally at 15½@15¾c. as an average for the week.

The London market has been quiet and weakish. On Jan. 30, standard spot copper was £68 17s. 6d., three months £69 5s. On Jan. 31, spot was £68 15s.; three months, £68 17s. 6d. On Feb. 4, spot declined to £67 17s. 6d., three months to £67

DAILY PRICES OF METALS

NEW YORK

Jan.-Feb.	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
30	4.8745	62	16¼ @16¼	15.80 @16.00	50¼	4.30 @4.35	4.15 @4.20	6.60 @6.75	6.45 @6.55
31	4.8710	61⅞	16¼ @16¼	15.80 @16.00	50¼	4.30 @4.35	4.15 @4.20	6.60 @6.75	6.45 @6.55
1	4.8730	61⅞	16¼ @16¼	15.60 @16.00	50¼	4.30 @4.35	4.15 @4.20	6.50 @6.60	6.35 @6.45
3	4.8730	62⅛	15¾ @16¼	15.60 @16.00	49¾	4.30 @4.35	4.15 @4.20	6.40 @6.50	6.25 @6.35
4	4.8740	62⅛	15¾ @16¼	15.60 @16.00	49¼	4.30 @4.35	4.15 @4.20	6.35 @6.40	6.20 @6.25
5	4.8745	62⅛	15¾ @16¼	15.60 @16.00	48¾	4.30 @4.35	4.15 @4.20	6.35 @6.40	6.20 @6.25

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. belo w that of electrolytic. The quotations for lead represent wholesale transactionsin the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Silver quotations are in cents per troy ounce of fine silver.

LONDON

Jan.-Feb.	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
30	28⅛	68⅛	69¼	75	228½	225½	16⅞	26
31	28⅛	68¾	68⅞	75	228½	224½	16½	26
1	28⅛	....	....	....	....	....	....	....
3	28⅛	68⅜	68½	75	224½	222	16 9/16	26
4	28⅛	67⅞	67⅞	75	224½	222½	16⅛	26
5	28⅛	66¾	66¾	74	222½	219¾	16⅝	26

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb, except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c.; = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 21¾c.

12s. 6d.; and on Feb. 5, it closed at £66 17s. 6d. for spot and the same for three months prompt. It will be observed that there has been a backwardation in the London market, which indicates the scarcity of near-by copper and the fact that there is a considerable bear account open in that market.

Base price of copper sheets has been reduced 1c. and is now 22@23c. per lb. Full extras are charged, and higher prices for small quantities. Base price of copper wire is 19c. per lb., carload lots at mill.

Copper exports from New York for the week were 11,421 long tons. Our special correspondent gives the exports from Baltimore at 850 tons for the week.

The rod mill of the John A. Roebling's Sons Co., at Trenton, N. J., burned on Feb. 1.

A contract for the supplying of equipment for the electrification of the surburban railroads of Melbourne, Australia, has just been secured by the General Electric Co.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield thereof is reckoned at 95%. In computing the total American supply duplications are excluded.

Company	Oct.	Nov.	Dec.	Jan.
Alaska shipments	1,435,235	1,671,367	3,766,029	.....
Anaconda	25,250,000	24,250,000	23,400,000	20,900,000
Arizona, Ltd	3,200,000	3,000,000	3,100,000	.....
Copper Queen	8,184,575	8,807,940	8,805,568	7,554,966
Calumet & Arizona	4,404,000	4,918,000	5,840,000	.....
Chino	3,638,500	3,911,169	3,368,850	.....
Detroit	1,934,828	1,968,620	2,389,875	1,769,071
East Butte	1,398,177	1,245,504	1,314,021	.....
Mammoth	1,883,283	1,805,869	.....	.....
Giroux	*nil*	*nil*	.....	.....
Mason Valley	1,563,700	.....	.....	.....
Nevada Con.	850,741	4,160,533	3,975,631	.....
Ohio	187,141	573,644	566,816	.....
Ould Dominion	2,523,000	2,758,000	2,262,000	.....
Ray	3,403,755	3,191,926	3,638,500	.....
Shannon	1,209,804	1,435,709	1,361,420	1,232,000
South Utah	*nil*	*nil*	*nil*	.....
United Verde*	2,750,000	.....	.....	.....
Utah Copper Co	2,022,352	4,562,417	5,676,484	.....
Lake Superior*	21,500,000	20,400,000	.....	.....
Non-rep. mines*	8,250,000	8,250,000	.....	.....
Total production	95,588,091	.....	.....	.....
Imports, bars, etc	28,205,270	22,797,099	.....	.....
Total blister	123,793,761	.....	.....	.....
Imp. in ore and matte	11,224,879	8,149,728	.....	.....
Total American	135,018,640	.....	.....	.....
Miami†	2,577,750	2,972,000	2,913,840	2,932,369
Brit. Col. Cos.:				
British Col. Copper	1,022,904	881,582	.....	.....
Granby	2,018,424	1,852,896	.....	.....
Mexican Cos.:				
Boleo†	2,612,400	2,315,040	2,480,240	.....
Cananea	4,428,000	5,064,000	4,592,000	.....
Moctezuma	3,045,667	2,112,377	2,793,781	2,913,294
Other Foreign:				
Cape Cop., S. Africa	757,120	907,200	770,560	.....
Kyshtim, Russia	.....	.....	.....	.....
Spassky, Russia	974,000	974,400	.....	.....
Tilt Cove, Newfoundland	86,785	.....	.....	.....
Exports from				
Chile	8,512,000	4,816,000	7,392,000	.....
Australia	9,520,000	10,752,000	9,856,000	.....
Arrivals in Europe$	13,771,520	12,976,320	16,363,200	.....

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

$ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

Month	United States			Visible Stocks.		
	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
I, 1912	119,337,753	62,343,901	80,167,904	89,454,695	158,323,200	247,777,895
II	116,035,809	56,228,368	63,148,096	66,280,643	154,851,200	221,131,843
III	125,694,601	67,487,466	58,779,566	62,939,988	141,142,400	204,082,387
IV	125,464,644	69,513,846	53,252,326	62,367,557	136,819,200	199,186,757
V	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913.	.....	.....	.....	105,312,582	78,491,840	183,904,422
II	.....	.....	.....	.....	77,504,000	.....

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Visible Stocks of Copper on Jan. 31 are reported as follows: Great Britain, 25,420; France, 4280; Rotterdam, 1400; Hamburg, 3500; afloat from Chile, 2500; afloat from Australia, 6000; total, 43,100 long tons, or 96,544,000 lb. This is an increase of 20 tons over the Jan. 15 report.

Tin—In the anticipation of unfavorable statistics, the London market developed a weaker tone during the latter part of last week. The increase of 3000 tons in the visible supplies, which became known when the statistics were made public on Feb. 3, created a selling movement on the London exchange, with the result that quotations dropped about £4 for spot and £3 for three months from the close of last week. Considerable transactions also took place on the New York Metal Exchange, especially in future tin, extending into August delivery at prices considerably below those quoted abroad. The lower basis reached was taken advantage of by home consumers, who contracted for a considerable part of their future requirements. The market closed weak at £222 15s. for spot and £219 15s. for three months, and about 48¾c. for February tin.

Visible Stocks of Tin on Jan. 31 were: London, 5559; Holland, 2368; United States, excluding Pacific ports, 6044; total, 13,971 long tons, an increase of 2994 tons during January.

Lead—The market is unchanged at 4.15@4.20c., St. Louis, and 4.30@4.35c. New York. The average price for the week was 4.325c., New York.

The London market is firmer, Spanish lead being quoted £16 15s., and English lead 7s. 6d. higher.

Spelter—There has been little demand and considerable pressure to sell, in consequence of which the market has had a further decline to 6.20@6.25c., St. Louis, and 6.35@6.40c., New York.

The foreign market is unchanged at £26 for good ordinaries and £26 12s. 6d. for specials.

Zinc dust is quoted at 7⅞c. per lb., New York.

Base price of zinc sheets was reduced ¼c. on Feb. 3 and is now $8.75 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market has been rather slow, and prices are easier. The foreign market continues steady. Quotations are a little lower, at 25¾@26c. per lb. for No. 1 ingots, New York.

Antimony—The market has been quiet and rather weak. There is some pressure to sell surplus stocks and prices are easier. Cookson's is 9.50@9.75c. per lb.; Hallett's 9@9.25c.; while 8@8.25c. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market has been rather quiet, but steady, and prices are unchanged. New York quotation is $40 per flask of 75 lb., with 59c. per lb. asked for retail lots. San Francisco, $40 for domestic orders and $37.50 for export. London price is £7 15s. per flask, with £7 10s. quoted by jobbers.

Zinc and Lead Ore Markets

JOPLIN, MO.—Feb. 1

The high price of zinc sulphide ore is $53, the base per ton of 60% zinc $45@50, with slimes at $43. Zinc silicate sold on a base of wide range, $25@31; extra sharp competition in one camp brought bids $3 per ton above offerings elsewhere in the district. The average price of all grades of zinc is $48.60 per ton. Three lots of lead sold on a base of $54 per ton of 80% metal content, $53 being the price on all other sales. The average price on all grades of lead is $52.72 per ton.

SHIPMENTS, WEEK ENDED FEB. 1

	Blende	Calamine	Lead Ore	Value
Total for week	12,381,180	514,410	1,436,440	$351,319
Five weeks	57,071,650	2,582,250	8,995,820	$1,781,495
Blende value, the week	$304,541; 5 weeks,			$1,503,028
Calamine value, the week	8,913; 5 weeks,			42,317
Galena value, the week	37,865; 5 weeks,			226,150

PLATTEVILLE, WIS.—Feb. 1

The base price paid the first of the week for 60% zinc ore was $52 per ton, but slumped to $47 at the week end. The base price paid for 80 per cent. lead ore was $51 per ton.

SHIPMENTS WEEK ENDED FEB. 1

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shipment for the week	3,423,570	229,610	1,062,620
Year to date	16,155,930	470,870	5,563,970

Shipped during week to separating plants, 2,131,140 lb. zinc ore.

NEW CALEDONIA ORES

Exports of ores from New Caledonia, as reported by the "Bulletin du Commerce" of Noumea, for the 11 months ended Nov. 30 were 69,339 metric tons of nickel ore and 43,790 tons chrome ore. Exports of metals were 3625 tons nickel matte.

IRON TRADE REVIEW

NEW YORK—Feb. 5

The iron and steel trades continue in very much the same condition as last reported. Mills continue busy with plenty of work ahead, and specifications come in quite freely. On the other hand, new orders are not heavy. Most large consumers seem to be pretty well covered by contract for the first half of the year and are not disposed to make comitments for the second half as yet. There is little doubt, however, of continued activity.

Rail orders continue to come in, although most of the large railroads have placed their 1913 orders. Still quite a number of lots are being placed and several foreign orders are on the market, including a large one for Argentina. Quite a number of orders for girder rails for trolley companies are also coming in. The demand for structural steel promises to be very large both East and West. The large Eastern fabricating companies especially are preparing for a pretty heavy business. Jobbing trade is reported good, although the spring business has hardly yet opened.

The pig-iron market has not been especially active, although there is a fair demand for basic iron. Foundry iron is being taken rather freely, but in moderate-sized lots, in seaboard territory. Prices are moderately firm, but Southern foundry is being offered at slight concessions.

In the government suit against the Steel Corporation, the testimony on the part of the government has been closed, the witnesses last examined giving evidence as to the Lake iron-ore situation, and especially as to the Great Northern leases. A recess has been taken for a short time and after that the evidence on behalf of the Corporation will be put in.

Wage Increases have been made to employees of the Steel Corporation in the Pitsburgh district. The advances are from 10 to 15%, the basis being 2.5c. per hour for ordinary labor. These advances have been thought necessary to hold labor at the mill. Nearly all the independent plants have followed and have made similar advances. The higher wages will be general in the district, dating from Feb. 1. The strike in the Steel & Wire Co. plants, at Rankin, is still unsettled. Increases have also been made, at Steel Corporation plants in the South, and at the Lake iron increases.

PITTSBURGH—Feb. 4

The situation continues generally unchanged. New buying remains rather light, but this is not considered of much importance, as it is believed that it will start up again long before the mills have worked off their present burden of orders. Boiler tubes have been advanced one point, or $2 per ton.

The mills which have generally been working smoothly have been bothered for two weeks or so by the floods and this week by very cold weather, so that they are hardly up to the mark. The labor troubles at Rankin have caused some delay, but it is not expected to continue. The advance in Steel Corporation wages is well received and is being generally followed by the independents.

Pig Iron—The bessemer average for January was $17.25; basic, $16.45, both at Valley furnace, 90c. higher delivered Pittsburgh. The market has been dull, but no changes in price of importance have been made. Quotations, rather nominal, are: Bessemer, $17.25; basic, $16.40@16.50; No. 2 foundry, $17.50; forge, $17, all at Valley furnace. The coke market is quiet and no higher. Prompt furnace may be quoted $3 per ton at ovens.

Ferromanganese—There is no change. Supplies are good. Both prompt and contract are quoted at $65, Baltimore. The expected increase of freights has not yet been made.

Steel—The question of supplies of billets and sheet bars is bothering many mills. In the absence of transactions we continue to quote billets at $29 and sheet bars at $30, maker's mill, Pittsburgh or Youngstown, with rods at $30, Pittsburgh.

Sheets—The sheet market continues extremely strong. Mills that can make early deliveries have no difficulty in selling their product at fancy premiums ,and special finish sheets can be sold even for second half at $1 to $3 above the regular base price, with full extras for finish besides. We quote: Blue annealed, 10 gage, 1.75@1.80c.; black, 2.35@2.40c.; galvanized, 3.50@3.60c.; painted corrugated, 2.55c.; galvanized corrugated, 3.55c. per pound.

IRON ORE

Sales of Lake ore have been practically closed for the season, nearly all the large consumers having made their reservations. Sales to Eastern furnaces have been smaller than was expected at one time. A good deal of dickering is going on in the East over supplies of local ores and some furnaces are objecting to the prices asked. Few contracts for foreign ores are reported.

COAL TRADE REVIEW

NEW YORK—Feb. 5

The coal-trade situation in the West is unchanged. A widespread storm and cold spell has not so far seriously affected domestic trade, as there is a general belief that the duration of cold weather will be brief. Steam-coal demand continues very good and prices at the chief consuming centers are pretty well maintained.

The Seaboard bituminous trade is rather quiet. Supplies are good and there is little change in prices. Anthracite has been temporarily boosted a little by the cold weather, but not to any great degree. Work at the collieries continues to be pushed and shipments are generally coming fairly well up to demand.

Coal Passing through Sault Ste. Marie canals for the full season of navigation was, in short tons:

	1911	1912	Changes
Anthracite	2,060,209	2,142,485 I.	82,276
Bituminous	13,272,667	12,789,109 D.	483,558
Total	15,332,876	14,931,594 D.	401,282

Total shipment of anthracite from Lake Erie ports for the season were 2,785,362 tons, of which 76.9% went to Lake Superior ports.

CHEMICALS

NEW YORK—Feb. 5

The general markets are steady and trade is good for the most part.

Arsenic—The market is quiet. Buyers are doing nothing and sellers are not pushing business. In the absence of trade prices are nominally unchanged, $4.50@4.62½ per 100 lb. being quoted.

Copper Sulphate—The market is steady with fair business. Prices are unchanged at $5.50 per 100 lb. for carload lots and $5.75 for smaller parcels.

Nitrate of Soda—Business is more active and prices are firmer. Spot is quoted 2.62½c. per lb., with 2.60c. named for March and April, 2.57½c. for May and June, and 2.55c. for July deliveries. Many inquiries are being received.

Imports and Exports of chemicals and fertilizers, including raw materials for chemical manufacture, in the United States for the 11 months ended Nov. 30, were as follows:

	Imports		Exports	
	1911	1912	1911	1912
Arsenic, lb.	4,887,897	5,642,756	3,684	.....
Copper sulphate, lb.	.....	.....	6,735,507	5,926,616
Bleach, lb.	75,763,915	68,977,924	17,804	400
Potash salts, lb.	575,895,653	574,599,983	2,728,992	4,399,743
Soda salts, lb.	20,918,942	10,892,696	568,184	413,586
Acetate of lime, lb.	.....	.....	69,462,343	70,067,333
Nitrate of soda, tons	485,287	466,441	6,554	8,619
Sul. ammonia, lb.	164,113,474	106,036,267	.....	357,600
Phospnates, tons	.....	.....	1,160,956	1,134,220
Sulphur, tons	20,741	26,885	28,085	57,437
Pyrites, tons	929,549	871,948	.....	.....
Magnesite, lb.	231,699,961	209,248,298	2,170,935	2,439,043

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported in 1912 was 375,664 tons.

HOBART

Petroleum ....

At Pittsburgh, Feb. 1, the Standard Oil buyers advanced prices 7c. per bbl., making Pennsylvania crude, the basis of oil values, $2.40. Other prices announced were. Mercer Black, $1.93; Newcastle, $1.93; Corning; $1.93, and Cabell, $2. Somerset and Ragland were unchanged. Advances are also announced in Lima and Indiana oils; and in Kansas and Oklahoma.

Assessments

Company	Delinq	Sale	Amt.
Andes, Nev.	Feb. 4	Feb. 25	$0.03
Belcher, Nev.	Feb. 7	Feb. 28	0.10
Confidence, Nev.	Feb. 7	Feb. 26	0.20
Consolidated Virginia, Nev.	Feb. 11	Mar. 4	0.15
Corbin Copper, Mont.		Apr. 22	0.50
Dry Cañon Con., Utah	Jan. 14	Feb. 12	0.001
Gould & Curry, Nev.	Feb. 8	Feb. 28	0.03
Hider-Nevada Copper, Nev.	Feb. 26		0.0½
High Grade, Mont.	Jan. 18	Feb. 18	0.0½
Hypotheek, Ida.	Feb. 21	Mar. 14	0.0½
Meicher, Utah	Feb. 11	Mar. 3	0 02
North Star, Nev.	Jan. 13		0.02
O.K. Silver M. & M. Co., Utah	Jan. 30	Feb. 20	0.0½
Ophir, Nev.	Jan. 23	Feb. 14	0.15
Pioche Metals, Nev.	Feb. 10	Mar. 17	0.01
Rescue Eula, Nev.	Feb. 5	Mar. 5	0.0½
Sandstorm-Kendall, Nev.	Jan. 6	Feb. 10	0.01
Sierra Nevada, Nev.	Jan. 30	Feb. 20	0.10
Spider, Utah	Feb. 5	Feb. 25	0.0½
Superior & Boston, Mont.	Jan. 4		1.00
Tonopah North Star, Nev.	Jan. 13	Feb. 17	0.02
Umatilla Tonopah, Nev.	Jan. 20	Feb. 24	0.01
Wabash, Utah	Jan. 24	Feb. 15	0.05
Western Star, Ida.	Feb. 12	Mar. 8	0.002

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	.....	24.081	27.190	.....
March	52.745	58.375	.....	24.324	26.875	.....
April	53.325	59.207	.....	24.595	27.284	.....
May	53.308	60.880	.....	24.583	28.038	.....
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.488	14.337	16.767	62.760	71.741
February	14.084	.....	14.329	.....	62.893	.....
March	14.698	.....	14.868	.....	65.884	.....
April	15.741	.....	15.930	.....	70.294	.....
May	16.031	.....	16.245	.....	72.352	.....
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.314	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	12.962	.....	195.036	.....
March	12.577	.....	192.619	.....
April	43.923	.....	200.513	.....
May	16.063	.....	208.830	.....
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	.....	3.946	.....	15.738	.....
March	4.073	.....	4.046	.....	15.997	.....
April	4.200	.....	4.118	.....	16.331	.....
May	4.194	.....	4.072	.....	16.509	.....
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	.....	6.349	.....	26.661	.....
March	6.626	.....	6.476	.....	26.048	.....
April	6.633	.....	6.483	.....	25.644	.....
May	6.679	.....	6.529	.....	25.790	.....
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	.....	13.28	.....	14.01	.....
March	14.95	.....	13.66	.....	14.10	.....
April	15.13	.....	13.90	.....	14.15	.....
May	15.14	.....	13.90	.....	14.12	.....
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS Feb. 4

Name of Comp.	Bid.
Acacia	.03
Cripple Cr'k Con.	.01⅛
C. K. & N.	.12
Doctor Jack Pot.	.06½
Elkton Con.	.61½
El Paso	6.05
Findlay	.05
Gold Dollar	.14½
Gold Sovereign	.02⅜
Isabella	.14⅛
Jack Pot	.05½
Jennie Sample	.05½
Lexington	.004
Moon Anchor	.008
Old Gold	.02⅛
Mary McKinney	.67
Pharmacist	.01½
Portland	.98½
Vindicator	.88
Work	‡ .004

SALT LAKE Feb. 4

Name of Comp.	Bid.
Beck Tunnel	.10
Black Jack	.11½
Cedar Talisman	.01½
Colorado Mining	.15
Columbus Con.	.10
Crown Point	.03
Daly-Judge	6.25
Grand Central	.74
Iron Blossom	1.27½
Little Bell	‡.10
Lower Mammoth	.04½
Mason Valley	8.00
May Day	.17
Nevada Hills	1.50
New York	.005
Prince Con	.87
Silver King Coal'n	2.97½
Sioux Con	.03½
Uncle Sam	.11
Yankee	.14

TORONTO Feb. 1

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.08	Foley O'Brien	.16
Coniagas	8.75	Hollinger	15.25
T. & Hudson Bay	63.00	Imperial	.02
Timiskaming	.35	Jupiter	.36
Wettlaufer-Lor.	.17	Pearl Lake	.45
Apex	.01	Porcu. Gold	.19
Crown Chartered	.01	Preston E. D.	.03
Dobie	.20	Rea	.20
Dome	18.00	Swastika	.09
Dome Exten.	.06	West Dome	.10

SAN FRANCISCO Feb. 4

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.04	Belmont	7.90
Belcher	.27	Jim Butler	.68
Best & Belcher	.03	MacNamara	.22
Caledonia	.67	Midway	.30
Challenge Con.	.04	Mont.-Tonopah	1.70
Chollar	.01	North Star	.20
Confidence	.37	West End Con.	1.37½
Con. Virginia	.12	Atlanta	.15
Crown Point	.21	Booth	.02
Gould & Curry	.03	C.O.D. Con.	.07
Hale & Norcross	.05	Comb. Frac.	.06
Mexican	.77	Jumbo Extension	.30
Occidental	.70	Pitts.-Silver Peak	.64
Ophir	.28	Silver Pick	.05
Overman	.34	St. Ives	.30
Potosi	.01	Tramp Con.	.01
Savage	.04	Argonaut	‡1.75
Sierra Nevada	.16	Bunker Hill	‡4.50
Union Con.	.16	Central Eureka	.21
Yellow Jacket	.20	So. Eureka	2.50

N. Y. EXCH. Feb. 4

Name of Comp.	Clg.
Amalgamated	73
Am. Agri. Chem.	53
Am.Sm.&Ref.,com	73⅛
Am. Sm. & Ref., pf.	106⅜
Am. Sm. Sec., pf. B	86
Anaconda	37⅞
Batopilas Min.	1⅛
BethlehemSteelpf	68½
Chino	42⅝
Federal M. & S., pf.	‡39
Goldfield Con.	2⅛
GreatNor.,ore,,ctf.	39¼
Guggen. Exp.	50
Homestake	118
Inspiration Con.	17
Miami Copper	23⅞
Nat'nalLead,com.	52⅛
National Lead, pf.	106
Nev. Consol.	18¼
Phelps Dodge	210
Pittsburg Coal, pf.	91½
Ray Con	19¾
Republic I&S,com.	27
Republic I & S, pf.	89
SlossSheffi'd,com.	44
Sloss Sheffield, pf.	93¼
Tennessee Copper	34¼
Utah Copper	54⅜
U. S. Steel, com.	64¾
U. S. Steel, pf.	109
Va.Car. Chem., pf.	109½

N. Y. CURB Feb. 4

Name of Comp.	Clg.
Barnes King	‡.86
Beaver Con.	.40
Braden Copper	9¼
B. C. Copper	4¼
Buffalo Mines	2¼
Caledonia	‡.40
Con. Ariz. Sm.	⅜
Davis-Daly	1⅞
Diam'field-Daisy	4
Ely Con.	.12
Florence	.43
Giroux	3
Gold Hill Con.	⅛
Greene Cananea	8¾
Greenwater	.05½
Internat. S. & R.	‡124
Kerr Lake	3¼
Keystone	‡2
La Rose	3⅛
McKinley-Dar-Sa.	2
Min. Co. of A. new	3⅛
Motherlode Gold.	‡.60
Nev. Utah M. & S.	‡.01
Nipissing Mines	9
Ohio Copper	⅝
Pacific Sm. & M.	1/16
Puebla S. & R.	2¼
South Live Oak	‡2
South Utah M. & S.	⅜
Standard Oil (Old)	1110
Stand'd Oil of N.J.	436
Stewart	1⅜
Tonopah	5⅞
Tonopah Ex.	2
Tonopah Merger	.86
Tri-Bullion	⅛
Tularosa	¾
Union Mines	1/16
United Cop., pfd.	10
Yukon Gold	3

LONDON Feb. 5

Name of Com.	Clg.
Camp Bird	£1 0s 0d
El Oro	0 17 9
Esperanza	1 13 9
Mexico Mines	6 12 6
Oriental Con.	‡1 10 9
Oroville	0 6 9
Santa Gert'dis	‡1 6 9
Tomboy	1 7 6

BOSTON EXCH. Feb. 4

Name of Comp.	Clg.
Adventure	4⅛
Ahmeek	315
Algomah	1¾
Allouez	38
Am. Zinc	30¾
Ariz. Com., ctfs.	3 1/16
Bonanza	.31
Boston & Corbin	7
Butte & Balak	‡3
Calumet & Ariz.	65¾
Calumet & Hecla	495
Centennial	16½
Cliff	‡3
Copper Range	47
Daly West	3½
East Butte	13¾
Franklin	7½
Granby	68½
Hancock	21½
Hedley Gold	30
Helvetia	‡¾
Indiana	14⅛
Island Cr'k, com.	‡55
Island Cr'k, pfd.	85
Isle Royale	28¾
Keweenaw	3¼
Lake	20
La Salle	4¾
Mass	4¾
Michigan	1¾
Mohawk	53⅜
New Arcadian	2¼
New Idria Quick.	⅛
North Butte	30½
North Lake	2½
Ojibway	‡23¾
Old Dominion	49½
Osceola	97
Quincy	73
Shannon	12
Shattuck-Ariz.	25⅞
Superior	4⅜
Superior & Bost.	4
Tamarack	32
Trinity	4½
Tuolumne	3¾
U. S. Smelting	40
U. S. Smelt'g, pf.	49
Utah Apex	‡2
Utah Con.	10⅜
Victoria	1⅝
Winona	3
Wolverine	‡67
Wyandot	‡1¼

BOSTON CURB Feb. 4

Name of Comp.	Last
Alaska Gold M.	15½
Bingham Mines	4½
Boston Ely	.81
Boswyocolo	‡.01
Butte Central	8½
Cactus	.06
Calaveras	3
Chief Cons	1⅛
Corbin	.40
Cortez	½
Crown Reserve	3⅜
First Nat. Cop.	2½
Majestic	.46
Mexican Metals	1⅛
Moneta Porc.	‡.03
Nevada-Douglas	2½
New Baltic	1
Oneco	1½
Raven Copper	.20
Rhode Island Coal	.10
San Antonio	‡3½
Smokey Dev.	2
S. W. Miami	3
South Lake	7
Trethewey	.40
United Verde Ext.	.76

‡Last quotation.